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EXPERIMENT STATION RECORD.

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Public interest in the reclamation of land for agricultural purposes has become quite generally aroused. It is one of the topics uppermost in connection with the settlement of the newer portions of the country, and represents one of the most prominent features of agricultural development. Its most familiar form is reclamation by irrigation, which has already greatly extended the area of agricultural production, and is rapidly spreading under the influence of Federal and private enterprise. Another form closely allied to it is the extension of dry-land or arid farming, carried on with crops which, under improved cultural methods, can be grown with a minimum of artificially supplied water, or with the natural rainfall of the country. Extensive areas are being brought under cultivation in this way which were formerly considered unadapted to farming and practically useless except for grazing.

There is another class of reclamation work whose practicability has largely been lost sight of in the rush for new lands, but which is bound to increase in importance and magnitude as the public mind becomes aroused to its possibilities. This is reclamation by drainage. It embraces tracts which, owing either to natural or artificial conditions, have been rendered practically waste land or unsuitable for cultivation except in favorable seasons. Large areas of such land await the development of the drainage engineer north, south, east, and west. These areas are not confined to any section, but are found at the coast, along river courses, in the level countries of the Middle West, and in the arid and semiarid regions of the West. Some of the land has been under cultivation and abandoned, while other has remained in a wild state and received no attention because of the supposed difficulties it presented.

The area involved is sufficient to make this phase of reclamation second to none in importance. In many cases these lands lie at the very gates of the eastern markets, and can be reclaimed at far less cost than new lands can be brought under irrigation. It is estimated that there are about one hundred million acres now unproductive which can

be reclaimed through dikes and drains. This if reclaimed would have a productive capacity equal to four times that of the State of Illinois, and would considerably exceed the probable area which can be reclaimed by irrigation, the extent of which appears to be diminishing with later estimates. Indeed, considerable of this land lies within the irrigated area, and its present condition has come about as a result of irrigation. According to a recent report of this Office, "there is scarcely an irrigated valley in the State of Utah which has been cultivated for a term of years in which some of the best land has not become too wet for cultivation and abandoned, or from which only uncertain crops of inferior value are now obtained."

Similar conditions exist throughout the irrigated districts. In those regions, therefore, irrigation and drainage necessarily go hand in hand. Either through the leakage of canals or through lavish use of water by irrigators, many thousand acres have become bogs and marshes by the accumulation of surplus and seepage waters. The rise of the soil water tends to drown out the roots of trees and plants, and the seepage water, passing down from canals and overflowed fields, carries with it the soluble salts of the soil, becoming more and more concentrated until an alkalied condition is produced.

The drainage problems of irrigated districts are not the same as those of the eastern part of the United States, but involve many new and complicated questions. The quantity of water to be removed can not be estimated with the same accuracy as where merely the rainfall is to be removed, for the source of the water supply is often obscure. It is impossible, without a preliminary study of conditions, to give reliable advice to farmers as to how they can restore their damaged fields. The rapidity with which the soil water rises when irrigation begins must be known in order to fix the capacity of drains, and the sources of the accumulated water must be ascertained to determine whether relief can be had by intercepting ditches, or whether a system of open or under drains is required.

But it is in the East that reclamation by drainage finds its greatest possibilities, owing both to the value of the reclaimed land and its proximity to markets. Here extensive areas are to be found which have either never been brought under cultivation, owing to their water-logged condition, or have been seriously injured and often abandoned by reason of overflow and conditions which have been brought about artificially. Such conditions are found along the whole Atlantic coast, and extend to the Gulf States as far west as Texas. In southern Louisiana and southern Texas are vast areas of land which there has either been no attempt to utilize, or has given discouraging results under cultivation, owing to the nearness of the water table to the surface. Such land, although located under climatic conditions which are

very advantageous to production, can be purchased at a low price—much lower in fact than land remote from markets and involving constant expense for water supply.

The everglades of southern Florida are attracting attention on account of their ability, under proper drainage and management, to produce subtropical fruits and vegetables for the northern markets. Large amounts of money have been expended in drainage works to lower the water along the border of the glades sufficiently to grow vegetables during the winter season, this land being mostly under water the remainder of the year. It seems likely that the area available for this purpose can be extended by the use of dikes and pumping, but this presents experimental features and its extension would ultimately involve large problems in drainage engineering.

It is estimated that there are 300,000 acres of marsh land in Wisconsin which at present have little or no value. This land is to a considerable extent of a moss-peat character, and its reclamation therefore requires somewhat different methods of treatment from that of ordinary swamp land. Such lands in other places have frequently not responded to ordinary methods of drainage, and special methods have had to be devised. In Sweden, for example, it is reported that more money has been wasted upon the drainage of moss-peat lands than upon any other improvements attempted, but a new system has at length been devised which is successful.

Another class of reclamation by drainage is that along the Illinois River. Here levee districts have been organized to reclaim about 74,000 acres of land, the drainage water being lifted over the levees by pumps when the river is high. In some of these districts the expenses for ditches, levees, and pumps have amounted to as much as $14 an acre, and the cost of pumping has been as high as $1 per acre in some years. But even this is insignificant in comparison with the expense of irrigation. Many of these reclamation works have failed in recent years owing to faulty and ill-advised construction.

Although farm drainage has long been practiced as one of the important aids to increased production, the drainage of large areas calls for expert advice in solving both the legal and engineering problems. It is now recognized that in many localities much drainage work has been poorly done, and that more scientific and thorough methods are required in draining land for the more intensive cultivation demanded on high-priced land.

In other words, in this as in other lines of agricultural development, systematic investigation and the services of experts are required to furnish a safe basis for large enterprises, and to work out the special problems presented by different sets of conditions. The field is one of immense possibilities, viewed either from the standpoint of reclamation or of the important agricultural problems presented.

During the past year or two studies of drainage projects of various kinds on a quite extensive scale have been made under the direction of the Irrigation Investigations of this Office, and the scope of this work is now being enlarged. These studies and the data collected have thrown considerable light upon the cost of reclamation by drainage under various conditions, the causes of failures, and the best methods of procedure; and they have also attracted attention to the feasibility and advantages of such reclamation. They have made it quite apparent that the problems of drainage where large areas are involved are far from being thoroughly worked out, and that this field presents as important and promising a one for investigation as any branch of engineering. In many States it lies at the very foundation of future agricultural development, and in other sections it is already a very present need, upon which depends the continued maintenance of lands now under cultivation.

While these problems of land reclamation by drainage, diking, etc., are largely in the domain of engineering, they are agricultural in their relationships and applications. The planning and inauguration of such work calls for some agricultural knowledge. The man with an agricultural outlook, who knows in a general way the methods and needs of different kinds of farming, has a distinct advantage over the man trained merely as an engineer; and, moreover, such a man can see the problems of a section, the possibility of remedying them, and the practicability of such an undertaking. In development work of this sort, the ability to see the problems and the possibilities of a section are of prime importance to both the projector and the investigator.

What is needed, therefore, is a class of men who combine engineering training with a thorough knowledge of agricultural conditions and an understanding of the practical requirements of farm life. Such men are to be found in Europe, where agricultural engineers are a recognized branch of the profession. The establishment of this work in the Department of Agriculture has brought together a number of this class of engineers. In this way the solution of these special problems is having the advantage of their combined special knowledge. The reception this work has met with leaves no question as to the need for it, and the results already achieved show its practical value. Demands for expert advice regarding drainage plans and for expert study of unsolved problems are being received from all sections of the United States, and are far in excess of the ability of the Office at present to meet.

Engineering, like all professions, is being specialized. In this specialization there would seem clearly to be a field in this country for the agricultural engineer. Such a man would combine with his technical engineering knowledge a familiarity with agricultural methods, condi-

tions, and requirements which would make him specially suited to deal intelligently with enterprises of that sort. Indeed, there is at present no little difficulty in securing sufficient men who have the special qualifications to undertake investigations in this field, and who will be able to see clearly the problems of a locality without special supervision.

Agricultural engineering is now attracting more attention as a definite branch of agricultural science and practice. It embraces a sufficiently comprehensive field to set it off as a department by itself, and it is clearly within the scope of the agricultural college to develop instruction in this branch, which is bound to become of increasing importance. Moreover, the colleges of agriculture and mechanic arts are peculiarly adapted to training men in this line, and they afford facilities which are not to be had at the ordinary engineering schools. The present interest and activity in investigation and reclamation work of this sort, and the probabilities of development in the near future, make the outlook for such specialists very good. The advantages which men trained in agricultural engineering would possess would soon come to be appreciated.

With the beginning of the seventeenth volume of the Record, the classification of the abstract part has been slightly modified and several new departments added. The changes in arrangement are made with a view to conforming more closely to the classification of agriculture and relating the pure to the applied science.

Rural engineering, which is rapidly growing in importance, has been made a separate editorial department, and it is planned to materially strengthen the review in this line. Rural economics is receiving more attention as a branch of agricultural instruction and investigation, and matters within its scope now go to make up a considerable literature. As these writings are scattered through quite a variety of periodicals, their review will be especially helpful to those interested in following the progress in this relatively new department and showing its relationships.

It has frequently been suggested that more attention be given in the Record to matters relating to agricultural education. In the past notes upon various phases of the movement have been presented from time to time, but hereafter a review of the more important papers, books, and other contributions which mark the progress of agricultural instruction in its various grades will be maintained, and this material will be brought together in a regular department of the Record.

It is hoped that these developments will make the journal a more helpful review to its present readers, and possibly extend its usefulness in new directions.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

A contribution to the determination of phosphoric acid by the citrate method, a hitherto overlooked source of error and a modification to avoid it, V. Schenke (*Landw. Vers. Stat.*, *62* (*1905*), *No. 1–3*, *pp. 3–10*).—This is an account of comparative tests on bone meal, Thomas slag, and soils of Märcker's molybdic method, the official citrate method of the German Association of Agricultural Experiment Stations, and a modified citrate method in which the acid solution of the material was neutralized with concentrated ammonia before the citrate solution and magnesia mixture were added.

The results obtained by the modified citrate method agreed more closely with those obtained by the molybdic method than was the case with the ordinary citrate method. It is pointed out that the citrate method is a "compensation method" in which the errors due to impurities of silica, lime salts, etc., are supposed to be balanced by those due to solubility of the magnesium-ammonium phosphate precipitate in ammonium citrate. The modified citrate method apparently gives a more perfect balance in this respect, due to the fact that less ammonium citrate is used (50 to 64 cc. as against 100 cc. in the ordinary method).

On the determination of phosphoric acid in Thomas slag, F. Westhausser (*Ztschr. Analyt. Chem.*, *44* (*1905*), *No. 3–4*, *pp. 187–191*; *abs. in Chem. Centbl.*, *1905*, *I*, *No. 19*, *p. 1434*).—Comparisons of the official method of the Association of German Agricultural Experiment Stations, the original Kellner-Böttcher method, and of the Kellner-Böttcher method using Hallens ammonium citrate solution. The methods proved very unreliable in case of substances like Wolter phosphate containing large amounts of silica.

Phosphoric acid determination, F. Raschig (*Ztschr. Angew. Chem.*, *18* (*1905*), *No. 10*, *pp. 374–376*).—A series of tests are reported to show that the amount of water used in washing the magnesium-ammonium phosphate prior to its titration with tenth-normal hydrochloric acid may with safety and advantage be reduced to 10 cc. The details of manipulation in carrying out the method are described.

The Pemberton method of determining phosphoric acid, D. J. Hissink and H. Van der Waerden (*Chem. Weekblad*, *2* (*1905*), *pp. 179–184*; *abs. in Chem. Centbl.*, *1905*, *I*, *No. 16*, *pp. 1188*, *1189*).—A modification of the method insuring uniform composition of the precipitate and fixed requirement of sodium hydroxid solution for titration is described.

Quick methods for the determination of lime, potash, and phosphoric acid, E. H. Schultze (*Chem. Ztg.*, *29* (*1905*), *No. 37*, *pp. 508*, *509*).—Titrimetric methods for the determination of calcium oxid in calcareous substances and phosphoric acid in phosphates, and a short method of determining potash as potassium platinic chlorid are described.

Maercker-Bühring solution, Wagner's citrate magnesia mixture, and iron citrate magnesia mixture, H. Svoboda (*Chem. Ztg.*, *29* (*1905*), *No. 33*, *pp. 453–456*).—A series of comparative tests of these mixtures with reference to the error due to their solvent action on glass is reported.

On the estimation of free acid and its relation to total acidity in superphosphate, J. OSTERSETZER (*Chem. News, 91* (*1905*), *No. 2372, p. 215*).—The method of using alizarin sulphonic acid as an indicator in the determination of free acid in superphosphates is briefly described.

The determination of perchlorates, M. DITTRICH and H. BOLLENBACH (*Ber. Deut. Chem. Gesell., 38* (*1905*), *pp. 751, 752; abs. in Jour. Chem. Soc.* [*London*], *88* (*1905*), *No. 510, II, p. 281*).—In the method proposed the perchlorates are reduced to chlorids by fusion in sodium nitrite.

The determination of perchlorates and chlorates in sodium nitrate, D. TSCHERNOBAJEFF (*Chem. Ztg., 29* (*1905*), *No. 32, pp. 442, 443*).—From investigations which are reported the author recommends that chlorates and perchlorates be determined together by Lemaître's method of reduction with sodium sulphite, and the chlorates be determined separately by reduction in the cold by means of iron and sulphuric acid according to Hendrixson's method.

Contribution to the analysis of nitrate of soda, R. BENSEMANN (*Ztschr. Angew. Chem., 18* (*1905*), *No. 21, p. 816*).—A form of an old method based on reduction with oxalic acid and fusion until carbonate is formed and nitrogen and chlorin are expelled is described and comparisons of it with the Hamburg method are reported.

A new method of determining magnesium carbonate in limestones, W. F. KOPPESCHAAR (*Ztschr. Analyt. Chem., 44* (*1905*), *No. 3-4, pp. 184-187, figs. 3*).—The method described is based upon the fact that when limestone is dissolved in the least possible amount of hydrochloric acid and the lime precipitated as sulphate by adding concentrated sulphuric acid the magnesia remains in solution. The filtrate therefore contains relatively a large amount of magnesia and a small amount of lime which can be precipitated as calcium oxalate almost free from magnesia.

Notes on the determination of nitrous acid, especially by the Trommsdorff method, H. LEGLER (*Pharm. Centralhalle, 46* (*1905*), *pp. 181-183; abs. in Chem. Centbl., 1905, I, No. 14, p. 1048*).—Precautions to be observed and apparatus to be used in order to secure accurate results are described.

The electrolytic estimation of small amounts of arsenic, C. MAI and H. HURT (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9* (*1905*), *No. 4, pp. 193-199, fig. 1*).—An improved method of estimating arsenic electrolytically is discussed.

The determination of boric acid, K. WINDISCH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9* (*1905*), *No. 11, pp. 641-660*).—This is a review of the different methods which have been proposed for the determination of boric acid, the foot-notes constituting a bibliography of the literature of this subject. Results obtained by the author with some of these methods are reported.

Gasometric determination of formaldehyde, G. B. FRANKFORTER and R. WEST (*Jour. Amer. Chem. Soc., 27* (*1905*), *No. 6, pp. 714-719, fig. 1*).—This method is based upon the fact that when potassium hydroxid is added to formaldehyde in the presence of hydrogen peroxid free hydrogen is liberated. The substitution of sodium peroxid for hydrogen peroxid gave slightly higher results.

The detection of hydrogen peroxid in milk, UTZ (*Milchw. Zentbl., 1* (*1905*), *No. 4, pp. 175-178*).—The author's experiments confirm the claims made for titanic and vanadic acids as suitable reagents for the determination of hydrogen peroxid in milk. The reaction may be obtained whether the milk is heated or not before the addition of the hydrogen peroxid. The hydrogen peroxid may be detected for a much longer period when the milk is heated before the preservative is added. An increase in temperature hastens the decomposition of the hydrogen peroxid.

The determination of water in foods and physiological preparations, F. G. BENEDICT and CHARLOTTE R. MANNING (*Amer. Jour. Physiol., 13* (*1905*), *No. 3, pp. 309-329*).—From comparative studies of different methods the conclusion was reached

that drying in a vacuum over sulphuric acid is the most satisfactory procedure in estimating water in foods and physiological products.

The high vacuum which is needed, the authors found, could be obtained by introducing a small quantity of ether into the desiccator containing the samples and exhausting with a suction pump. It is desirable, in the authors' opinion, to have a manometer in the desiccator and to dry the samples in aluminum dishes of special construction with covers, although suitable glass dishes with covers may also be used.

As regards the time required for drying, "a marked difference exists between materials of a vegetable and those of an animal nature, the former retaining their moisture persistently, while the latter have, in general, lost all but mere traces of their moisture after 2 weeks in a high vacuum. For animal materials, therefore, we may say that 2 weeks in a high vacuum suffices to remove practically all moisture. For the most accurate work a longer time is to be recommended, though the slight loss in weight subsequent to 2 weeks' desiccation can hardly effect ordinary physiological or chemical research. With vegetable materials, desiccation should proceed for a period longer than 2 weeks [as slight loss in weight was noted after this].

"As a matter of fact, however, it can readily be seen that the sample, as soon as prepared for analysis, can be placed in the vacuum and weighed as soon after 2 weeks as the results are needed. In general, the time between the preparation of a sample for analysis and the time when the results are imperatively needed is considerably over 2 weeks. For preliminary determinations in metabolism experiments, where an approximate knowledge of the water-content of foods is necessary, the usual five-hour heating will suffice, and the final calculations may be based on the determination by the vacuum method. For technical work, obviously the method is, as already stated, too time-consuming, though the advantages may appeal to the technical analyst and the method may possibly find some use in special cases. . . .

"The complete dehydration of butter in a high vacuum is of especial interest, when we consider the difficulties usually experienced in securing an equal distribution of the material in the sample dish and the passage of the water through the supernatant layer of melted fat. It is worthy of note that in several tests made with the vacuum method no special degree of importance could be ascribed to an even distribution of the sample. Desiccation was equally complete whether the sample was first melted in a thin layer on the bottom of the dish, or large irregular lumps of butter were used."

Studies were made of the effect of different degrees of rarefaction on the dehydration of samples. When the atmospheric pressure was reduced to 86 mm. the efficiency of dehydration was considerably increased over that noted in the desiccator at atmospheric pressure, and when the degree of rarefaction was less than 1 mm. of mercury the increased efficiency of desiccation became very marked. "This is easily explained by the fact that the tension of aqueous vapor at the laboratory temperature (20° C.) is about 17 mm. of mercury, and consequently a pressure of 86 mm. requires a considerably higher temperature to cause the tension of aqueous vapor to equal that of the gaseous medium. On the other hand, with the high vacuum, the temperature of the room is perhaps 20° above the boiling point of water at this degree of rarefaction, and consequently evaporation of water proceeds with great rapidity. A consideration of these facts explains the slow action of vacuum-drying as usually carried out, and also accentuates the importance of using a manometer inside the desiccator to indicate the pressure conditions after exhaustion."

In view of the results obtained the authors do not believe that drying in partial vacuum with heat is necessary or desirable.

The determination of water in molasses, G. Testoni (*Staz. Sper. Agr. Ital., 37 (1904), No. 4-5, pp. 366-369*).—Different methods of estimating water in molasses were compared.

The commercial analysis of cane molasses. I, Optical methods, H. E. SAWYER (*Jour. Amer. Chem. Soc., 27 (1905), No. 6, pp. 691-713, dgm. 1*).—In the method previously proposed by the author for dark materials the normal weight of molasses—26.048 gm.—is made up to a volume of 500 cc. instead of 100 cc., as customary. This method has been tested by the author for 4 years, and while no claim is made that precision is attainable, it is believed to be very suitable for practical purposes.

Different methods of fat determinations in milk, F. FRIIS, E. HOLM, and A. V. KRARUP (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög [Copenhagen], 56 (1905), pp. 1-23*).—The report gives the results of an investigation of the reliability and comparative value of the extraction method of milk analysis and the Gottlieb-Röse method. The errors of analysis found in the case of the former method are of especial importance in the analysis of skim milk and buttermilk, in the case of which it may give from 0.1 to 0.2 per cent too low results.

The "sin-acid" method of fat determination in milk was also studied, the results showing that ordinary mixed milk containing formalin in the proportion of 1:2,000, if left for some time (14 days), will give too low results; also that the method is not applicable to analysis of skim milk and buttermilk. As the "sin-acid" method has, however, been modified since this work was done, it is felt that the method must still be considered in the experimental stage.—F. W. WOLL.

The new method of determining fat in milk, Sichler's "sin-acid" butyrometry, G. CORNALBA (*Staz. Sper. Agr. Ital., 38 (1905), No. 3, pp. 227-240*).—Comparative determinations by the Sichler and Gerber methods are reported. The results agreed very closely. The advantages and disadvantages of the new method are pointed out.

Detection of added water in milk, UTZ (*Milchw. Zentbl., 1 (1905), No. 5, pp. 209-211*).—The author discusses the detection of water in milk by means of tests for nitrates and by the index of refraction. The disappearance of nitrates in milk when added in water was believed to be associated with the development of lactic-acid bacteria, which could of course be lessened by pasteurization. It is believed that heating milk has no effect on the index of refraction.

Table for computing the total solids and the solids-not-fat in milk from the specific gravity and the fat content according to the Fleischmann formula, RÜTTNER and ULRICH (*Milch. Ztg., 34 (1905), No. 18, pp. 214, 215*).

Contributions to the examination of butter, M. SIEGFELD (*Milchw. Zentbl., 1 (1905), No. 4, pp. 155-171*).—The author reviews recent investigations relating to the methods of butter analysis and reports determinations of the Reichert-Meissl, Polenske, saponification, and iodin numbers and the mean molecular weight of the volatile and nonvolatile fatty acids in a number of samples of butter from 2 large dairies.

The results are discussed at some length as regards the value of the different determinations in detecting adulteration. While the addition of cocoanut fat to butter may be detected by means of the methods of Juckenack, Polenske, and Bömer, it is not believed that there is at present a satisfactory method for the positive detection of the addition of animal fats.

The extraction of tanning materials with various extractors, F. P. VEITCH (*Jour. Amer. Chem. Soc., 27 (1905), No. 6, pp. 724-729, fig. 1*).—This paper, which was presented before the Association of Official Agricultural Chemists at its meeting in 1904 (E. S. R., 16, p. 328), gives the comparative results obtained on different materials with 3 extractors.

The determination of ash in plant substances, E. GUTZEIT (*Chem. Ztg., 29 (1905), No. 40, p. 556*).—The method of incineration with basic calcium phosphate first proposed by Ritthausen is described.

On the use of sodium carbonate and oxalate in acidimetry, S. P. L. Sørensen and A. C. Andersen (*Ztschr. Analyt. Chem., 44 (1905), No. 3-4, pp. 156-184*).—Investigations are reported which, it is claimed, show the reliability of these substances as means of titrating acids if a gas flame containing sulphur is not used with the first, and corrections for impurities made for the second.

Report of the chemical department of the Swedish Moor Culture Station, 1903-4, H. von Feilitzen (*Svenska Mosskulturför. Tidskr., 20 (1905), No. 3, pp. 157-188, figs. 4*).—The report, which covers the period from November 15, 1903, to December 31, 1904, gives the results of analyses made during the year of soils, soil amendments, fertilizers, crops, and technical moorland products. Views of the laboratories of the station are also given, with plan of the rooms and invertories.—F. W. Woll.

Progress in the field of agricultural chemistry during 1904, A. Stutzer (*Chem. Ztg., 29 (1905), No. 20, pp. 257-261*).—A review, with numerous references to literature, of investigations in chemistry as applied to soils, plant production and physiology, fertilizers, animal physiology, feeding stuffs, soil bacteriology, and methods of agricultural analysis.

Review of foreign work in agricultural chemistry, C. W. Harrison (*Jour. Amer. Chem. Soc., 27 (1905), No. 6, pp. 761-776*).—This is a brief and partial review of articles relating to the chemistry of fertilizers, soils, field crops, dairying, and animal feeding which have appeared in foreign publications during the last few years.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 33 (1905), Nos. 1, pp. 1-40, figs. 3, charts 11; 2, pp. 41-84, figs. 3, charts 17; 3, pp. 85-126, figs. 3, charts 12*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of January, February, and March, 1905, recent papers bearing on meteorology, recent additions to the Weather Bureau Library, etc., these numbers contain the following articles and notes:

No. 1.—Special contributions on Escape of Gases from the Atmosphere, by G. J. Stoney; The Coordinates of the United States Weather Bureau Station at Mount Weather, Va. (illus.), by H. H. Kimball; The Proposed Competition in Forecasting at Liege, by B. Brunhes; Solar Halo of February 3, 1905, at Washington, D. C. (illus.), by E. R. Miller; Meteorological Charts of the Indian Ocean, by C. F. Talman; Earthquakes of January and February, 1905, by C. F. Marvin; and Dr. J. O. Harris, by W. G. Burns; and notes on apparatus for instruction in physics and meteorology, a river and flood service on the Grand River of Michigan (illus.), Weather Bureau men as instructors, methods of measuring duration of rainfall, and low temperature at Thompson Hill, Conn.

No. 2.—Special contributions on A Relation Between Autumnal Rainfall and the Yield of Wheat of the Following Year—Preliminary Note, by W. N. Shaw (E. S. R., 16, p. 955); Contributions to Marine Meteorology; High Water in the Great Lakes (illus.), by A. J. Henry; Unusual Weather at Dodge, Kans., by E. D. Emigh; Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—I, The Diurnal Periods of the Temperature (illus.), by F. H. Bigelow; and Mathematical Theory of Ice Formation, by S. T. Tamura; and notes on the fourth international conference on aerial research, the Meteorologia generale di Luigi de Marchi, Pernter's theory of the rainbow (illus.), meteorology in Haiti, and Weather Bureau men as instructors.

No. 3.—Special contributions on Application of Mathematics in Meteorology, by F. H. Bigelow (E. S. R., 15, p. 20); Tornado in Eastern Alabama, March 20, 1905 (illus.), by F. P. Chaffee; Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—II, The Diurnal Periods of the Barometric Pressure, by F. H. Bigelow;

Snowfall and Water Equivalent, by H. C. Frankenfield; Earthquake of March 21, 1905, by C. F. Marvin; The Variations in Atmospheric Transparency during 1902, 1903, and 1904, by H. H. Kimball; Twilight Glows and Connected Phenomena Observed in 1902, 1903, and 1904 in the Pyrenees, by E. Marchand, trans. by Miss R. A. Edwards; and the Solar Eclipse of August 30, 1905, as Visible in the United States (illus.), by W. F. Rigge; and notes on Tornado near Bluff Springs, Fla., March 20, 1905, and Weather Bureau men as instructors.

Meteorological notes for the year ending September 30, 1904, A. Lander (*East Kent Sci. and Nat. Hist. Soc. Rpt. and Trans., 2. ser., 4 (1904), pp. 37–40, pl. 1, fig. 1*).—The weather conditions at Canterbury during the year are briefly summarized and the telluradiometer, "a new instrument for accurately measuring terrestrial radiation and foretelling the weather by indicating the variations in the amount of aqueous vapor present in the atmosphere," is briefly described.

Periodic variation of rainfall in the arid region, W. B. Stockman (*U. S. Dept. Agr., Weather Bur. Bul. N, pp. 15, map 1*).—This is a paper which was read before the Twelfth National Irrigation Congress at El Paso, Texas, November, 1904, and summarizes information relating to the character, distribution, and amount of precipitation throughout the arid region of the United States. Data are compiled "for a few stations in each State, selected so as to best show the average conditions that have obtained generally over the State and region, due consideration also being given to length and continuity of record and altitude of station."

Climate of the Province of San Luis, Argentine Republic, A. L. Cravetti (*An. Min. Agr. Argentina, Secc. Agr. (Agron.), 1 (1904), No. 5, pp. 67–83*).—This is one chapter of a detailed report on the agricultural conditions of this province, summarizing the meteorological conditions (temperature, pressure, rainfall, wind) of the region.

Climate of the Province of Buenos Ayres, Argentine Republic, R. J. Huergo (*An. Min. Agr. Argentina, Secc. Agr. (Agron.), 1 (1904), No. 2, pp. 72–88*).—This article forms part of a detailed report on the agricultural conditions of this province. It summarizes the available meteorological data with reference to diurnal variations in temperature, average and extreme monthly temperatures, mean temperatures for different stations, winds, atmospheric pressure and humidity, and rainfall.

The action of cannon used for protection against hail, J. Violle (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 6, pp. 342, 343*).—The results of hail protection experiments made during 1904 by the Syndicate of Beaujolais over an area of about 12,000 hectares. and also tests made in Côte-d'Or are summarized. It is claimed that the results are encouraging and indicate that the cannonading tends to restore the electrical equilibrium and so mitigates storm conditions.

Frost protection experiment in Hohenheim, 1904 (*Gartenwelt, 9 (1905), No. 24, pp. 285–287*).

Influence of the temperature of the earth's surface, of thermal inertia, and of radiation on errors in the determination of the temperature of the air, P. Borisov (*Izv. Moskov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 10 (1904), No. 3, pp. 546–594*).—This article reports data collected at the Moscow Agricultural Institute, which show that the temperatures registered by thermometers in shelters differ from those of the free air, being influenced by the temperature of the surface of the soil or of the plant cover, the direction and movement of the wind, radiation from the shelter, etc.; and it was further noted that the temperature in an ordinary wild shelter lags behind that of the air, sometimes to the extent of one hour.—P. FIREMAN.

On the presence of formaldehyde in the atmosphere of towns, A. Trillat (*Bul. Soc. Chim. Paris, 3. ser., 33 (1905), No. 7, pp. 393–395*).—Studies similar to those reported by Gautier and Lévy and Henriet (E. S. R., 15, p. 957; 16, p. 238) are reported. A method of preparing a neutral chlorhydrate of rosaniline test paper

which can be used for detecting the presence of formaldehyde in the atmosphere is described.

Evaporation observations in the United States, H. H. KIMBALL (*U. S. Dept. Agr., Weather Bur. Doc. 327, pp. 8, figs. 2*).—Reprinted from Monthly Weather Review for December, 1904 (E. S. R., 16, p. 954).

Copper as an algicide and disinfectant in water supplies, G. T. MOORE and K. F. KELLERMAN (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 76, pp. 55*).—This bulletin is supplementary to Bulletin 64 of the Bureau of Plant Industry (E. S. R., 16, p. 238), and gives the results of treatment under the direct supervision of representatives of the Laboratory of Plant Physiology of a number of lakes and reservoirs during the summer of 1904. Definite recommendations are given regarding the methods of procedure, for the guidance of those having to deal with the question of contaminated water.

The results are summarized as follows:

"During the summer of 1904 over 50 reservoirs were successfully treated for the removal of algæ. From these results and from further experiments in the laboratory and elsewhere the following facts have been developed:

"Much less copper is required to eradicate algæ from reservoirs than would be necessary to destroy algæ under laboratory conditions.

"The effect of this metal upon fish is of considerable importance and requires more study.

"The physical and chemical constitution of a water are factors to be considered in determining the quantity of copper sulphate to use in a water supply.

"The elimination of polluting forms sometimes makes possible the development of other species, but so far these species have never been the cause of complaint.

"As a result of the sudden destruction of great numbers of polluting algæ for a few days immediately after treatment of a water supply there is sometimes an increase in odor and taste.

"The use of copper is an efficient emergency method for sterilizing water contaminated with the bacillus of typhoid fever.

"Metallic copper offers a convenient and efficient means of sterilizing small amounts of water.

"Copper may be useful in the proper disposal of sewage.

"Copper is of great value as a supplement to filtration in case of accident or mismanagement.

"Under certain conditions copper may be used to great advantage in connection with filtration.

"There is no authentic record of fatal copper poisoning, and many of the best authorities do not consider copper a true poison; they hold that it is a natural constituent of the body, and in minute quantities has no effect upon man.

"The suggested medicinal use of copper in cholera, typhoid, and related diseases seems important."

The copper sulphate treatment for algæ at Middletown, N. Y., J. M. CAIRD (*Engin. News, 53 (1905), No. 2, pp. 33, 34*).—The successful treatment of three reservoirs is reported.

Interpretation of a water examination, W. P. MASON (*Science, n. ser., 21 (1905), No. 539, pp. 648–653*).—A general discussion of this subject in which "blind adherence to cut and dried standards" is cautioned against, as is also the hasty adoption of the copper method of purifying water.

The softening of hard water by heating it under pressure, N. KNIGHT (*Engin. News, 53 (1905), No. 12, pp. 311, 312, fig. 1*).—The results of comparative tests of the effect on hardness of boiling water under normal pressure and under pressure of 6 or 7 atmospheres are reported.

It was found "that the precipitation of calcium carbonate is substantially the same in each case, while the precipitation of magnesium carbonate is increased by the difference between 8.52 and 4.61, or 3.91 by the greater pressure. Boiling for 20 minutes at the normal pressure removes 44 per cent of the temporary hardness; that is, the calcium and magnesium carbonates. At the increased pressure, 63.5 per cent is removed. The water, therefore, can not be said to be softened by either process. It was found . . . that on treating the raw water with lime water in the ratio of 6 to 1, 71.42 per cent of the temporary hardness was removed."

A study of the underground waters of the region of Cadereita Mendez, State of Queretaro, J. DE D. VILLARELLO (*Bol. Sec. Fomento* [*Mexico*], *2. ser., 4* (*1905*), *Propaganda No., Pamphlet 13, pp. 5–55*).

SOILS FERTILIZERS.

Investigations in soil management, F. H. KING (*U. S. Dept. Agr., Bur. Soils Bul. 26, pp. 205, pls. 4, figs. 9*).—The three papers included in this bulletin belong to a series of 6 papers constituting the report of the Chief of the Division of Soil Management of the Bureau of Soils for 1902 and 1903. The other three papers of the series were published privately by the author, and have already been noted (E. S. R., 16, p. 546). In recommending the papers for publication, the Chief of the Bureau of Soils explains that the Bureau assumes no responsibility for the opinions and conclusions they contain.

I.—Amount of plant food readily recoverable from field soils with distilled water (pp. 13–78, figs. 3).—This paper reports and discusses "the results of two seasons' investigations relating to the amounts of plant-food materials and other water-soluble salts which could be recovered from different soil types and from the same soil types under different conditions by bringing them into contact with distilled water for a very brief period only." The more important soil types in a number of the areas surveyed by the Bureau of Soils in Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Virginia, and Wisconsin were studied. "One of the most important objects of these investigations was to ascertain what relation, if any, exists between the character and amounts of the water-soluble salts present in a soil and the yield and quality of crop matured upon it at the same time. In planning and executing those studies the work was so shaped that as far as possible the investigations should be made in direct connection with some crop or crops whose yields could be definitely ascertained and whose growth was under observation."

Earlier investigations along the same line are reviewed. The methods of taking soil samples and preparing the soil and plant extracts are described. "In preparing the soil extract the cores of the soil sample were well broken down and thoroughly mixed in a granite-ware basin. Two 100-gm. samples were then weighed out on a Springer torsion balance, one being transferred to a Wedgwood mortar and the other to the dry oven for moisture determinations. In a graduated flask 500 cc. of distilled water were measured out, and enough was added to the sample in the mortar to work it into a thick paste with the pestle, breaking down the granulations, when the balance of the water was added and the whole stirred continuously with the pestle during 3 minutes. The supernatant turbid liquid was then transferred to a pint Mason jar and from here, usually inside of 15 minutes, to the filter chambers. . . . By means of compressed air in the reservoir the solutions were filtered, under a pressure of about 30 to 40 lbs., through Chamberland-Pasteur filters, and perfectly clear extracts obtained in from 5 to 20 minutes, depending upon the character of the soil or the amount of fine sediment remaining suspended in the solution to be deposited upon the walls of the filters. . . .

"In the preparation of plant extracts for the work here reported the samples were always taken at the places where the soil samples were procured, and at the same

time, in order that the observed soil and plant data might be as definitely related as possible. The plants were cut up when fresh, care being taken to avoid wilting, into fine pieces, to permit of reliable sampling. Then 100 gm. were dried for moisture determination, and 20 gm. were transferred at once to the mortar and thoroughly crushed with the pestle, after which 500 cc. of distilled water were added. The whole was stirred with the pestle during 3 minutes, and the solutions were decolorized and filtered." Decolorization was accomplished by the use of 3 to 5 gm. of carbon black to 100 gm. of soil, or to 20 gm. of green plant. This usually rendered the solution colorless after standing 15 to 20 minutes with frequent agitation.

The methods used in analyzing the extracts have been described in a previous bulletin of the Bureau (E. S. R., 15, p. 457). The earlier studies reported were made with fresh samples of soil. For reasons already noted (E. S. R., 15, p. 233) oven-dried samples were used in the later work.

The results show in general that relatively large amounts of salts are either actually in solution in the soil moisture of the fields examined, or are in such form that they at once enter solution when that moisture is diluted with distilled water, although there were considerable differences between the groups of soils from the different States in the amounts of solids which were recovered from them by extracting with distilled water. It was also shown that the application of fertilizers very materially increased the amounts of salts recovered from the soils.

"The largest amount of solids recovered from the surface-foot of any soil was 934.7 parts per million in the case of a Janesville loam, and the smallest amount, omitting three doubtful results, came from the Selma heavy silt loam, 140.9 parts per million of the dry soil. The first, or largest amount, represents well up toward 2 tons of soluble matter per acre-foot, or 0.3 per cent of the soil moisture, computed on a saturation equal to one-third the dry weight of the soil. . . . There appears to be no relation of amounts of water-soluble salts to the size of soil grains, unless possibly the phosphates recovered do increase as the size of the soil grains decreases." The total water-soluble salts recovered from 8 soil types ranged from nearly an even ton per acre in Norfolk sand to 3 tons in Janesville loam, distributed through the surface 4 ft. of soil.

Data are also reported showing the increased amounts of soluble matter obtained from soils by repeated washing and drying and by continuous percolation; the amounts of soluble salts carried by well and drainage waters, and plant food removed from soils by crops as compared with the amounts recovered by distilled water. The ground waters were found to have a higher content of nitric acid than running waters. It was also shown "that, from the surface 4 ft. of soil, there was recovered per acre enough nitrogen, by the three-minute washing, for a crop of 2½ tons of clover hay. Of potash, there was enough recovered for two, and of phosphorus enough for about five such crops."

II.—Relation of crop yields to the amounts of water-soluble plant-food materials recovered from soils (pp. 79–124, pl. 1, figs. 6).—This paper presents "a study of existing field conditions and relations, [including] a critical comparative study of 8 soil types, bearing the same 2 crops, where all of the conditions under control were made as closely similar as practicable. . . . The prime object was the fullest attainable knowledge of the character of the soil solution and a correlation of this character with different soil types, with different methods of soil management, and with the yields of crops. In carrying out that study the work was so planned that, as far as possible, the soluble-salt determinations were made in connection with some crop whose yields were ascertained and whose growth was under observation." Previous work of like nature, especially that done at Rothamsted and at the Wisconsin Station, is reviewed.

The investigations reported were made on 8 soil types in 4 different States. The crops experimented with were cotton, peas, beans, corn, and oats. The influence of manure and guano and of the moisture content of the soil was also studied.

By the method of washing the soils, carried through the season, and by examining the plant sap of the crops growing upon the soils, it was shown that the recoverable water-soluble salts were materially larger where the yields were also larger.

"The evidence here presented, taken all in all, makes it clear that, in so far as the soils investigated are concerned, there is a well-marked tendency for larger amounts of water-soluble salts to be recovered by the methods adopted from the soils upon which crops have made the largest yields. That the observed differences in yield are due to the observed differences in the salts present in the soils is a distinctly different matter."

There was shown to be "a rather remarkable concordance between the yields and the recovered potash, indicating that the variations in the amounts of potash, in soluble form in the soil, have been more influential in determining differences in yields than have those of the other ingredients studied."

III.—Relation of differences of climatological environment to crop yields (pp. 125–205, pls. 3).—This paper reports and discusses observations made during 1903, in connection with the investigations noted above, at Goldsboro, N. C., Marlboro, Md., Lancaster, Pa., and Janesville, Wis., on some of the climatological conditions affecting the soils and crops. They include records of rainfall, sunshine, soil temperatures and moisture, air temperatures at 4 ft. above the soil in a corn field, and evaporation from a soil saturated by capillarity, as well as "a comparative soil moisture study made on 8 soil types, in which the effect of limiting the capillary supply of moisture and of excluding the rainfall, upon the growth of corn and upon the water content of the soil, [was] determined. . . .

"In order to make a comparative study of the rate of evaporation from continuously moist soil surfaces a soil evaporimeter was constructed from galvanized iron in the form of a cylinder, with closed bottom, 2 ft. deep, which was sunk in the field. . . . The cylinder had a diameter of 4 ft. and was arranged in such a way that an automatic record of the rate of evaporation might be obtained by the use of a water register. . . .

The evaporimeters . . . were all filled with soil from the unfertilized subplots, using soil from the surface 9 in. The soil was introduced in layers about 2 in. thick and firmed so as to secure about the normal weight per cubic foot for the soil in place.

"At the bottom of the evaporimeter there was a water reservoir, rising to the height of 1 ft., upon which the shelter for the water register rested. Water could be added to or removed from the reservoir as desired. Upon this water surface rested the float of the water register. Before introducing the soil the bottom of the evaporimeter was covered with a layer of sand or gravel, thus providing a medium through which the water could spread easily and uniformly under the whole soil surface. The level of the surface of the soil in the evaporimeter was about 2 in. below that of the rim, and was left firm, smooth, and horizontal, and was kept free from all plant growth throughout the season. The level of the water in the reservoir was usually maintained at about 1 ft. below the surface, water being added once per week and removed when made necessary as the result of rains."

A set of similar evaporimeters 4 ft. deep and having a larger reservoir were used for studying evaporation from corn plants grown on the different soils.

In order "to ascertain in how far the soil moisture contained in the soil at the beginning of the growing season is capable of carrying a corn crop toward maturity when no rain is allowed to fall upon the ground, and what the yields would be . . . 2 blocks of soil on each of the 2 soil types at each of the 4 stations were cut off from

the adjacent soil of the field by digging trenches around them to a depth of 4 ft. and incasing these blocks in a framework of lath so as to shut them off from a supply of moisture through lateral capillary movement from the adjacent soil, and in one block in each set the cube was cut off from a capillary supply of water from below by a similar provision. After the blocks had been thus incased the soil was returned to the trenches about them, and corn was planted on the blocks in the soil in its natural field condition, holding the moisture which had been acquired during the rains which had preceded the beginning of the experiment. . . . There was thus secured, on each of the two types of soil at each station, one set of cubes, 4 ft. on a side, where the soil was left in its natural undisturbed condition, and which contained the natural amount of moisture of the field at the time, but from which all supplies of moisture from the sides and from the bottom were cut off, and a second set of cubes in which, while the supplies of moisture from the sides were cut off, there was free opportunity left for a capillary rise of moisture from below. . . .

"From the results regarding yields, the only conclusion which it appears legitimate to draw is that the moisture relations came to be so prejudicial to growth that in no case could the development be even approximately normal."

How to build up worn-out soils, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 6, pp. 15, figs. 2*).—This is a discussion of this subject based upon the results of 8 years' study at the Tuskegee Station, "emphasizing the subject of crop rotation, deep plowing, terracing, fertilizing, etc., keeping in mind the poor tenant farmer with a one-horse equipment."

The results are thus summarized: "(1) It pays to make a good seed bed by preparing the soil deep and pulverizing it thoroughly; (2) swamp muck and leaf mold are valuable as a fertilizer and should be used whenever they can be gotten easily; (3) deep plowing permits the water to go into the soil, thus reducing the terracing to a minimum, which gives more area upon which to grow crops, and also renders cultivation much more easy; (4) peanuts should be grown by every farmer; (5) with proper manipulation our poorest soils may be made to produce an abundance of the staple crops."

The composition of West Prussian soils, M. SCHMOEGER (*Landw. Jahrb., 34 (1905), No. 2, pp. 145-164*).—The agricultural and geological characteristics and mechanical and chemical analyses of 30 soils with corresponding subsoils are reported and discussed.

Geological observations on analyses of some West Prussian soils, A. JENTZSCH (*Landw. Jahrb., 34 (1905), No. 2, pp. 165-176*).—The relations of the geological origin and character to chemical composition of 30 soils and subsoils are discussed.

The chemical nature of the soils of New South Wales with special reference to irrigation, F. B. GUTHRIE (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. LI-LXV*).—A general discussion of this subject, including analyses of typical soils from the semi-arid parts of New South Wales.

Soil investigations [in the Philippines], A. M. SANCHEZ (*[Philippine] Bur. Agr. Rpt. 1904, pp. 63-76*).—This report is largely devoted to a description of certain explorations in Benguet, Cagayan, Isabela, and Union Provinces, and to a history and description of the methods of cultivation of tobacco and other crops in these districts. Physical and chemical analyses of soil samples are presented and compared with soils in certain areas in the United States.

The rational classification of sand and gravel, A. ATTERBERG (*Chem. Ztg., 29 (1905), No. 15, pp. 195-198*).—A new classification of the different grades of soil particles which it is believed to be desirable to separate in mechanical soil analysis is given and discussed with reference to the bearing of mechanical analysis on productiveness of soils.

The mineralogical analysis of soils, J. DUMONT (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 16, pp. 1111-1113*).—The methods used by the author are

described in detail. These methods involve 2 series of operations, (1) the separation of the unaltered sand by means of chemical reagents, and (2) the separation of the different minerals which are present.

Denitrification of soil, III, G. AMPOLA (*Gaz. Chim. Ital., 34 (1904), II, pp. 301–315; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 509, II, p. 194*).—Studies are reported which lead to the following conclusions:

Applications of calcium and sodium nitrates give better results than no nitrate, the calcium nitrate being more effective than the sodium nitrate. Green manures give better results than well-rotted stable manure, the latter better than fresh stable manure, and fresh stable manure better than straw. The general conclusion, confirming results previously obtained, is that calcium nitrate, a natural product of nitrification, is a better fertilizer than sodium nitrate. The calcium salt, moreover, offers greater resistance to the action of the denitrifying organisms than the sodium salt, denitrification depending mainly upon the character of the organic matter of the manure.

The author believes that danger from denitrification in the soil may be wholly or partially obviated only when the organic substances have been decomposed—that is, when the denitrifying organisms have been reduced to a state of inactivity.

Experiments on the accumulation and utilization of atmospheric nitrogen in the soil, E. B. VOORHEES and J. G. LIPMAN (*Jour. Amer. Chem. Soc., 27 (1905), No. 5, pp. 556–589*).—A series of pot experiments are reported which were designed to show the relation of leguminous crops, such as cowpeas, to soil nitrogen and to determine as far as practicable the value of such crops as a source of nitrogen to subsequent nonleguminous crops.

"The facts established in this experiment are of very considerable practical importance, even though the experiment itself was carried out under conditions more or less artificial. They demonstrate, in no uncertain manner, that the bacterial activities that concern the gain and loss of nitrogen in the soil are manifold and complex, and yet susceptible of differentiation. Evidently there was a gain of nitrogen in the box soils by means of symbiotic fixation where the cowpea crop was grown."

Substantially the same matter has been published as Bulletin 180 of the New Jersey Stations (E. S. R., 16, p. 1063).

The absorptive property of the leaf cover of the soil of forests, E. HENRY (*Bul. Soc. Sci. Nancy, 3. ser., 5 (1904), No. 2, pp. 105–115*).—Studies by Calas's method of the absorptive capacity for water of the undisturbed leaf cover of one square meter of forest soil showed that a cover of picea needles absorbed 418 gm. of water per 100 gm. dry weight of cover, and beech leaf cover absorbed 538 gm.

The varying absorbent power of soils for bone superphosphate and mineral superphosphate, C. MONTANARI (*Staz. Sper. Agr. Ital., 38 (1905), No. 3, pp. 253–258*).

Agricultural phosphate, BACHMANN (*Fühling's Landw. Ztg., 54 (1905), Nos. 2, pp. 49–51; 3, pp. 84–90; 4, pp. 136–142; 5, pp. 177–185*).—A series of comparative tests of this phosphate and Thomas slag on a variety of crops grown on loam and sandy soils are reported.

The "agricultural phosphate" used was a crude phosphate containing 22 to 24 per cent of total phosphoric acid. The Thomas slag contained about 20 per cent of total phosphoric acid, of which about 16 per cent was soluble in citrate solution. The results show that the two phosphates were about equally effective on the loam soils, but that the "agricultural phosphate" was somewhat less effective than Thomas slag on the sandy soils.

Fertilizer experiments with calcium cyanamid on common soils and on moor land, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 2, pp. 100–110, figs. 2*).—Experiments conducted during the season of 1904 with barley, oats, wheat, and potatoes indicated that this fertilizer on certain soils, like clayey and

sandy soils, as well as on the better kinds of decomposed moor soils, gave considerably poorer results than nitrate of soda, and was not quite equal to sulphate of ammonia. On poorly decomposed white-moor soils its effect was insignificant, and its use on such soils can not therefore be recommended.—F. W. WOLL.

Manurial experiments with calcium cyanamid and garden plants, R. OTTO (*Gartenflora, 53 (1904), No. 20, pp. 534–538; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 509, II, p. 196*).—"Calcium cyanamid was found to be equal to nitrates and ammonium salts in the case of spinach, although at first growth was somewhat retarded. Equally satisfactory results were obtained with lettuce when planted 12 days after manuring. The results of pot experiments showed that calcium cyanamid gave better results with white cabbage and maize than sodium nitrate. The manure seems to be suitable for garden plants, provided that it is applied a week or two before planting, or else dug in to a depth of 13–26 cm."

The action of nitrate of soda and sulphate of ammonia in connection with lime on sandy soils, BACHMANN (*Fühling's Landw. Ztg., 54 (1905), No. 6, pp. 219–223*).—Comparative tests of these 2 materials with and without the addition of lime on barley, oats, and beets are reported. The results show that the action of the ammonium sulphate was increased by the addition of calcium carbonate; that of nitrate of soda was not materially affected.

The use of leucin and tyrosin as sources of nitrogen for plants, L. LUTZ (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 6, pp. 380–382*).—Sand cultures with pumpkins and cultures in Raulin's solution with fungi (Aspergillus and Penicillium) indicate that leucin and tyrosin are readily assimilated by both phanerogams and fungi.

Inoculation of soil with nitrogen-fixing bacteria, A. F. WOODS (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 72, pt. 4, pp. 10*).—In this publication the author briefly describes the commercial production of cultures of nitrogen-fixing bacteria, states when inoculation is necessary and when it is not to be recommended, and describes various conditions under which failures may be expected. Directions for the handling of the culture material are given, and certain dangers that may attend inoculation by soil transfer are pointed out.

On the results of four years' culture and liming experiments on moor soils, B. HARDT (*Deut. Landw. Presse, 32 (1905), No. 29, pp. 253, 254*).

On the injurious effect of an excess of lime applied to the soil, S. SUZUKI (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1905), No. 4, pp. 347–351*).—A series of pot experiments with rice to further elucidate the cause of the depression of availability of phosphoric acid in presence of large amounts of lime is reported.

It was found that an excess of calcium carbonate depressed the yield very decidedly notwithstanding the fact that phosphoric acid was applied in the easily available form of secondary sodium phosphate. On the other hand, the application of calcium sulphate under the same conditions resulted in an increased yield, indicating that the application of the carbonate depressed the assimilability of the phosphoric acid. The application of powdered magnesite at a rate furnishing three times as much magnesia as lime greatly depressed the yield. The application of moderate amounts of lime in connection with bone dust did not noticeably diminish the yield. This occurred, however, in a soil containing 11 per cent of humus.

The analyses of stone lime, prepared lime, oyster-shell lime, wood ashes, and marl, L. A. VOORHEES (*New Jersey Stas. Bul. 183, pp. 27*).—Chemical and physical examinations of a large number of samples of these materials are reported and discussed. Practical directions regarding the use of lime are quoted from Pennsylvania Department of Agriculture Bulletin 61 (E. S. R., 12, p. 627).

Analyses and other studies of West Prussian marl, lime, and other commercial lime fertilizers, M. SCHMOEGER (*Landw. Jahrb., 34 (1905), No. 2, pp. 177–232*).—A large amount of analytical data is reported and discussed.

Commercial fertilizers, A. Goss and W. J. Jones, Jr. (*Indiana Sta. Bul. 106, pp. 52, map 1*).—The results of analyses of 643 samples of fertilizers inspected during 1904 are reported and discussed.

Fertilizer inspection, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 114, pp. 37-52*).—"This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before March 1, 1905."

Analysis of commercial fertilizers sold in Maryland, H. B. McDonnell et al. (*Md. Agr. Col. Quart., 1905, No. 27, pp. 52*).—This is a report on fertilizer inspection during the period from July, 1904, to January, 1905, inclusive.

Report of analyses of samples of fertilizers collected by the commissioner of agriculture during the summer and fall of 1904 (*New York State Sta. Bul. 266, pp. 231-261*).—Analyses of samples of fertilizers collected by the commissioner of agriculture of New York during the fall of 1904 and transmitted for analysis to the director of the State experiment station, in accordance with the proprovisions of Article XII of the new agricultural law. It is explained that the analyses are published by the station in accordance with the provisions of Chapter 570, Laws of 1904, and that discussion of the results of the inspection and the explanatory and informational matter heretofore accompanying the reports of the inspection of fertilizers are omitted in accordance with the ruling of the commissioner of agriculture.

Licensed commercial fertilizers, F. W. Woll and G. A. Olson (*Wisconsin Sta. Bul. 122, pp. 1-16, 22-24*).—Analyses and guaranteed composition of fertilizers licensed for sale in Wisconsin during 1905 are reported, with notes on composition, valuation, and purchase of fertilizers, and the text of the State fertilizer law.

The by-products of maritime fisheries: Fish oils and fertilizers, D. Bellet (*Rev. Sci. [Paris], 5. ser., 3 (1905), No. 16, pp. 488-492*).—A general discussion of this subject.

AGRICULTURAL BOTANY.

The regeneration of seedling roots after splitting, Lura A. Warner (*Rpt. Mich. Acad. Sci., 6 (1904), p. 78*).—An abstract is given of a report on experiments with roots of beans, in which the regeneration after splitting is noted. When the roots are split they assume a half-moon shape in cross section. This cross section becomes rounded out by the formation of callus over the cut surface, and the 4 to 7 fibrovascular bundles which are contained in the roots under normal conditions have their functions taken up by about 3 bundles after splitting. Otherwise the regenerated root acts in a perfectly normal manner.

Notes on the regeneration of the hypocotyl of flax, Mary E. Hedden (*Rpt. Mich. Acad. Sci., 6 (1904), p. 79*).—The effect of removing the cotyledons from flax seedlings is shown, and notes also given on the conditions influencing the regeneration of buds which develop below the cotyledons. Uninjured plants did not develop the buds in dry atmospheres, but where the cotyledons were cut off, in the course of a few days numerous buds were developed under both dry and moist conditions. The number of buds produced was influenced by the age of the plant, the young hypocotyls sending out from 1 to 60 buds, while on the old ones never more than 3 were formed. More buds developed in a saturated atmosphere than in a dry one, and they developed very quickly at a high temperature.

The experiments show that age, moisture, temperature, light, and season are all important factors in influencing the formation of hypocotyl buds.

The regeneration of the epicotyl in bean and pea seedlings, Arabel W. Clark (*Rpt. Mich. Acad. Sci., 6 (1904), p. 80*).—A brief abstract is given showing the results of experiments carried on to ascertain the ability of bean and pea seedlings to repair injuries.

Cotyledons were planted with a small piece of epicotyl left attached, and it was found that the whole plant was regenerated. This took place whether a whole cotyledon or only a piece of the cotyledon was left intact, indicating that regeneration is not wholly dependent on the food supply. When the epicotyl was injured or removed, buds which had been produced in normal growth developed, and upon the removal of these other shoots continued to appear until all the embryonic tissue was dead. After the epicotyl had attained a height of about 10 cm., regeneration became uncertain, and at 20 cm. only an occasional seedling was able to regenerate mutilated portions, even though the cotyledons were found to be rich in food supplies.

The author concludes that regeneration of the epicotyls of beans and peas is dependent more upon the age of the tissue than upon the amount of food supply at hand.

On different degrees of availability of plant nutrients, O. LOEW and K. ASO (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1905), No. 4, pp. 335–346*).—The results of studies on the chemical availability of lime and magnesia are given, from which the authors claim that the former ratio of lime to magnesia, or the lime factor as it was called (E. S. R., 15, p. 1062), was based on the idea of an equal state of availability of the lime and magnesia present in the soil.

It has since been learned that the ratio changes with the availability of the bases, and magnesia in the burnt form is more available than in the pulverized magnesite. The magnesium sulphate is still more available than either. The physiological action of lime and magnesia must be distinguished from the changes which these bases exert upon the soil. Gypsum acts indifferently on account of its low availability. The carbonate of lime is much more available for plant use.

Can aluminum salts increase plant growth? Y. YAMANO (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1905), No. 4, pp. 429–432*).—Experiments are reported with barley and flax grown with and without various amounts of ammonium alum, from which it appears that this salt exerts a stimulating effect when used in moderate quantities.

The action of poison on plants, E. VERSCHAFFELT (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 6 (1904), pt. 2, pp. 703–707, dgm. 1*).—The author claims that the ability to absorb water through the osmotic properties of the protoplasm will continue until the cell walls allow no further expansion or the plant is killed.

When any part of an organ is previously killed no water is absorbed. On the contrary the dissolved substances in the cell sap are diffused out. This fact the author makes use of as a basis for determining the action of poisons on plants, and reports upon investigations with portions of potato tubers, beet roots, leaves of aloes, and leaf stalks of the begonia and other plants. A piece of tissue was considered undamaged if after having stayed in the poisonous solution for 24 hours and then in water for 48 hours it continued to gain in weight.

The effect of a number of substances on portions of plants is shown, indicating the harmful limit of concentration. This was determined for copper sulphate at between 0.002 and 0.003 grammolecule per liter. It was found also that the harmful limit of concentration may be determined for neutral mineral salts which in certain dilutions are not injurious. Sodium chlorid was found to partially neutralize the poisonous effect of a number of organic poisons, such as oxalic acid, chinine hydrochlorid, etc.

Concerning cauliflorous flowers and fruits, L. BUSCALIONI (*Malpighia, 18 (1904), pp. 50, pls. 2; abs. in Bot. Centbl., 96 (1904), No. 49, pp. 578, 579*).—A critical review is given of observations and theories regarding the direct occurrence of flowers and fruits on the trunks and larger branches of trees, such as cacao, calabash, and other tropical trees.

The author believes the production of flowers and fruit in this manner to be a primitive characteristic which persists in many plants that live in moist, hot regions. The

especial significance of this unusual method of fruiting is held to be a means of protection of the flowers against too much rain and also to protect them and the fruit from excessive heat, the trunks of the trees being usually the portion best shaded. These plants are also said to have especial devices for protection against insects.

The frost injuries of leaves, H. SOLEREDER (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *12* (*1904*), *No. 6–8, pp. 253–262, figs. 8*).—A description is given of the anatomical changes caused in apricot and beech leaves by the action of frost.

Physiological drought in relation to gardening, I. B. BALFOUR (*Plant World*, *8* (*1905*), *No. 1, pp. 1–5*).—After discussing the water relationships of plants when grown under natural conditions, the author considers the water requirements of plants under horticultural practice, and states that in no direction has research in recent years provided more valuable data of significance to horticulture than in that of water relationship of plants.

The relation of soils to physiological drought is discussed, after which the author calls attention to a number of gardeners' problems and offers explanations concerning them. Among these may be mentioned the explanation of marsh plants growing in sand, epiphytic orchids grown in pots containing peat, the changed condition of epiphytic plants when grown in greenhouses, conditions of physiological drought caused by cold, pot cultivation, etc. A proper conception of the explanation of all these phenomena is held to be requisite for the rational cultivation of plants.

Anthocyanin and its biological significance in plants, L. BUSCALIONI and G. POLLACCI (*Atti Ist. Bot. Univ. Pavia, 2. ser.*, *8* (*1904*), *pp. 135–511, pls. 10*).—The authors present an elaborate memoir on the occurrence and biological significance of anthocyanin.

After a discussion of pigments and other coloring matters in plants, the authors give an account of the localization of anthocyanin in different parts of plants, its chemical composition, spectroscopic analysis, influence of media, climate, etc., on its formation, the relation of this coloring matter to various physiological activities of plants, pathological conditions, etc. Experiments are described at length on the distribution, localization, effect of various physical and other agents on the production of anthocyanin, etc.

The investigations are summarized and various hypotheses are offered regarding the rôle of anthocyanin in plants. A bibliography of nearly 1,000 references to literature is given.

Investigations on chlorophyll assimilation, G. POLLACCI (*Atti Ist. Bot. Univ. Pavia, 2. ser.*, *8* (*1904*), *pp. 1–66, pls. 3*). The results of a prolonged series of investigations on chlorophyll assimilation and the various factors which determine and modify photosynthesis are given. A considerable list of publications consulted is appended as a bibliography.

The importance of the removal of the products of growth in the assimilation of nitrogen by the organisms of the root nodules of leguminous plants, J. GOLDING (*Jour. Agr. Sci.*, *1* (*1905*), *No. 1, pp. 59–64*).—In order to ascertain the rôle of the host plant in the process of nitrogen assimilation the author planned a series of experiments, the main feature of which was the removal of the soluble products of growth in a way similar to that which occurs in nature. This removal was affected by the use of a porous Chamberland filter candle fixed in the culture vessel.

The leaves, stems, roots, and nodules of young bean plants, water extracts of young pea plants, and sterilized extracts of similar plants were cultivated. In the first experiments the plants were simply cut up and bruised in a mortar, the initial infection being provided by the organisms present in the crushed tubercles. In the later experiments with sterile liquids the cultures were inoculated from pure cultures of the organisms grown on agar. The details of the experiments are given and the amount of nitrogen fixed in each case is shown.

In conclusion the author states that his experiments showed that larger amounts of nitrogen were assimilated in artificial cultures than in any previous experiments, indicating that the conditions of growth obtaining in the culture vessels favored the assimilation of nitrogen. From this it seems probable that one of the functions of the host plant is the removal of soluble products of growth, which when present in previous artificial cultures have prevented the assimilation of nitrogen.

The fungicidal action of fungus cultures, Y. KOZAI and O. LOEW (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1904), No. 2, pp. 77-79*).—The authors cite a number of instances in which the inhibiting action of the growth of certain organisms toward others is shown and give brief notes on their investigations on the effect of cultures of fungi and bacteria on the development of other organisms subsequently added to the media.

The subject has an economic application in the failure to ferment miso, the Japanese vegetable cheese, during very hot weather. The explanation of this failure is the possibility of the inhibiting action of other organisms which readily grow at temperatures higher than the optimum for the miso organism.

Symbiosis between Azotobacter and Oscillaria, H. FISCHER (*Centbl. Bakt. [etc.], 2. Abt., 12 (1904), No. 6-8, pp. 267, 268*).—Notes are given on the symbiotic association of species of Azotobacter and Oscillaria, and the author points out the symbiotic relationships which exist between a number of other species of plants.

Relationship of Macrophoma and Diplodia, JULIA T. EMERSON (*Bul. Torrey Bot. Club, 31 (1904), No. 10, pp. 551-554, pl. 1*).—While making studies of fungi occurring on flower bud spathes of cocoanut, the author was led to examine the associated Macrophoma and Diplodia species.

Cultures taken from the spathes were reasonably sure to produce typical spores of each fungus. The different forms were isolated and studied, and the author concludes that the unicellular white spores in the pycnidia of Macrophoma are simply the immature form of mature Diplodia spores. The Macrophoma form of this species was described originally under the name *Sphæropsis palmarum*, a technical description of which is given.

Notes on the blackening of Baptisia tinctoria, JULIA T. EMERSON (*Bul. Torrey Bot. Club, 31 (1904), No. 12, pp. 621-629*).—The blackening of the wild indigo (*Baptisia tinctoria*) after the opening of the flowers is a phenomenon of common observation, the entire plant, even to its flowers, frequently turning black.

The author has made a study of the possible causes of this change, and arrives at the conclusion that the blackening is due to the action of oxidizing enzyms. There are said to be at least two enzyms present, an oxidase, which gives an opalescent blue with a gum guaiac solution and which is destroyed at temperatures of 83-84° C., and a peroxidase, which gives a deep blue with hydrogen peroxid and which has a thermal destruction point of 86-87° C. Both enzyms are destroyed by dilute solutions of citric acid and sodium hydroxid.

FIELD CROPS.

Report of the Upper Peninsula Substation for 1904 [Field crops], L. M. GEISMAR (*Michigan Sta. Spec. Bul. 31, pp. 1-23*).—The weather conditions of the season are noted and the results with the different field crops are reported. The work of former years has been previously described (E. S. R., 16, p. 250).

Wet weather in May and September favored rust attacks in the grain crops. In the experience of the station oats have been more affected by rust than the other cereals, and no so-called rust-proof varieties have resisted rust attacks. Early Champion oats was practically free from rust in 1904, but this was due to its early maturity. The yields of different varieties under test ranged from 25 to 47.5 bu. per acre. The leading varieties were Early Champion, White Shonen, University No. 6, and

American Banner, yielding 47.5, 46.25, 42.5, and 40 bu. of grain per acre, respectively. The lowest yield of straw, 2,280 lbs. per acre, was produced by University No. 6, and the highest, 5,920 lbs., by American Banner.

The most productive varieties of barley were Champion, Manscheuri 6-rowed, University No. 105, and Chevalier, the corresponding yields being approximately 48, 46, 39, and 35 bu. per acre. White Hulless barley gave the lowest yield of grain and the highest yield of straw. Dawson Golden Chaff winter wheat yielded over 25 bu. per acre, and Saskatchewan Fife and Velvet Chaff spring wheats about 20 bu. A plat of spelt or emmer yielded at the rate of 70 bu. of grain and 2,800 lbs. of straw per acre.

Buckwheat was very successful; the leading variety, known as Rye buckwheat, gave a yield per acre of 36 bu. Of the different varieties of field peas tested, French June has given the best results, the yield this season being at the rate of 30 bu. of peas and 2,440 lbs. of straw per acre. Canadian Blue and Scotch also gave good yields. The varieties of corn giving greatest promise of success were Will Dakota, Gehû, Golden Dent, and Early Adams.

Notes are given on the growth of lentils, flax, and hemp, and a list of grasses and leguminous forage crops. The heaviest yields per acre among the forage crops were as follows: German alfalfa 11,280 lbs., alsike clover 6,800 lbs., meadow fescue 6,720 lbs., Siberian millet 6,400 lbs., Hungarian millet 6,080 lbs., and tall meadow oat grass 5,680 lbs. German and American alfalfa gave better results than either French or Turkestan alfalfa.

Of 21 varieties of potatoes Dolsen ranked first, with a yield at the rate of 290 bu. per acre, and Carman No. 3, Sir Walter Raleigh, and Northlight ranked next. Potatoes planted June 6 yielded 4,106 lbs. and those planted November 6, 4,111 lbs. of tubers per acre. A culture test resulted in favor of level cultivation by 277 lbs. per acre. Spraying with Bordeaux mixture gave slightly better results than no treatment.

The sugar content of Friedrichswerther Elite and Jaensch Victrix sugar beets, grown in 1903, was 14.2 and 15 per cent, respectively. Sugar beets left unharvested in 1903 began to blossom the next season on July 13, when the plants were about 3 ft. high, and the first seed ripened the latter part of August. The plants continued to grow and blossom and were about 7 ft. high when injured by frost September 22. In 1904 Jaensch Victrix yielded at the rate of 20,328 lbs. per acre, and of 2 samples analyzed, one showed a sugar content of 18.8 per cent and the other of 15 per cent.

In addition to sugar beets, carrots, turnips, ruta-bagas, parsnips, kohl-rabi, mangels, and garden beets were grown. The approximate yields of the leading varieties in bushels per acre were as follows: Maud S. carrots 1,082, Yellow Stone turnips 1,540, Prize Winner ruta-bagas 1,115, Marrowfat parsnips 774, Purple Vienna kohl-rabi 968, Improved Dignity Red mangels 484, and Improved Long Dark Blood beets 420. A number of varieties of each crop are briefly described.

Root systems of field crops, J. H. Shepperd (*North Dakota Sta. Bul. 64, pp. 525–540, figs. 10*).—This study of the root growth of plants is in continuation of previously reported work (E. S. R., 12, p. 516).

The root systems of corn, potatoes, winter rye, wheat, barley, oats, emmer, flax, brome grass, slender wheat grass, red clover, crimson clover, and alfalfa are presented in the illustrations, and the manner of preparing the samples is described. The corn root samples secured at the station and at the Edgeley Substation showed that at Edgeley the roots did not penetrate the soil so deeply as at Fargo, which is considered as probably due to an underlying strata of shale. The observations made again point to the necessity of shallow cultivation. The potato root studies also indicated that shallow cultivation must be practiced.

The roots of the winter rye sample, taken July 7, reached a depth of only 3 ft., and their development was smaller than in other samples of cereals generally. It is

believed that early in the season the soil in that latitude is too cold below a depth of 3 ft. to admit of root growth. The roots of durum and bread wheat reached a depth of more than 4 ft., and showed that the system of rooting is vertical instead of lateral, as in corn and potatoes. The root development was greater in the durum than in the bread wheat samples. As observed by the station, the root development in cereals varied considerably during different years.

The samples of barley and oats showed a comparatively light and shallow root growth. The roots of emmer resembled those of wheat and extended to a depth of 3½ ft. The flax roots grew almost directly downward and branched very little. In the specimens studied they had reached a depth of 4 ft. The brome grass specimen taken from a 3-year-old sod showed the densest rooting of all samples. Native slender wheat grass, also from a 3-year-old sod, did not have the strong root growth of the brome grass, but its root system was heavier than that of any other crop studied. During 2 years of growth the roots of red clover had grown down over 4 ft. and had quite fully occupied the upper 3 ft. of soil. Crimson clover roots in a single season had attained a depth of 3 ft. by August 22.

Hand hoeing of grains, K. Kubis (*Deut. Landw. Presse, 32 (1905), No. 11, pp. 84, 85*).—Experiments conducted in 1903–4 are reported, and the results show that barley, oats, and wheat were profitably hoed with a hand hoe working two rows at a time. The larger yields are considered as resulting from preventing the formation of a crust on the surface of the soil, and in general to the conservation of soil moisture. The stubble on the hoed plats was plowed under easier and better than on the check plats.

The influence of seed, soil, and fertilizers on the endosperm of spring wheat and barley, H. von Feilitzen (*Jour. Landw., 52 (1904), No. 4, pp. 401–412*).—Experiments were conducted for 2 years on 4 different kinds of soils, and the results show that in the same sample of spring wheat or barley the hard glassy kernels are richer in protein than those of a mealy constituency.

Glassiness or mealiness in the seed produced no effect upon the yield or upon the size of the kernel, but apparently exerted a slight influence upon the glassiness and mealiness of the grain. The proportion of glassy kernels was found to be greater and the protein of the grain was higher, as a rule, on moor soil than on soil of mineral origin. The climatic conditions of the season are considered as producing a marked effect on the quality of the grain. Nitrogenous fertilizers, in general, increased the percentage of glassy kernels.

It is concluded that the soil, the fertilizers used, and especially the weather conditions, exert a greater influence upon the texture of the grain of either spring wheat or barley than the seed, and that the use of mealy seed can not be regarded as a factor in breeding a better barley for malting purposes.

The influence of fallow and pea culture on the nitrogen balance of soils and the growth of wheat, F. Wohltmann and P. Schneider (*Deut. Landw. Presse, 31 (1904), No. 102, pp. 853–855*).—The results of experiments showed that the fallowed soil was in a better physical condition and also furnished a larger supply of nitrates to the succeeding crop than the soil which had produced a crop of peas. The ammonia content of the soil did not show marked differences.

Fallow is considered more advantageous to a succeeding crop of winter wheat than pea culture on account of the greater amount of soil moisture it provides. Four varieties of winter wheat after fallow gave higher yields of grain and straw, and one variety a smaller yield than when grown after peas. The weight of the grain, as determined for 3 varieties, was in every case in favor of the wheat grown after peas.

Crops for the silo, cost of filling, and effect of silage on the flavor of milk, W. J. Fraser (*Illinois Sta. Bul. 101, pp. 627–644, figs. 7*).—This bulletin discusses the advantages and value of silage, the crops best grown for the purpose, the

time and method of harvesting them, and the essentials of silo filling. Records of the cost of filling the silo, kept by the station on 19 different farms in various parts of the State, show a range of from 40 to 76 cts. per ton, the average being 56 cts. The effect of silage on the flavor of milk is noted elsewhere.

Manurial experiments on permanent meadow land (*Harper-Adams Agr. Col. Bul. 2, pp. 3*).—Different fertilizer applications were compared on meadow land of a stiff clay loam resting on a deep bed of clay overlying red sandstone. The most profitable returns were obtained from the use of 2½ cwt. of superphosphate and ½ cwt. of sulphate of potash per acre. Nitrate of soda at the rate of 1½ cwt. per acre was ineffective, and 10 tons of barnyard manure per acre was also unprofitable. The use of barnyard manure reduced the quality of the herbage.

Range management in the State of Washington, J. S. COTTON (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 75, pp. 26, pls. 3*).—This bulletin briefly reviews the history of the ranges in the State, suggests methods for their improvement, and discusses the management of pastures. The important species of forage plants growing on the different grazing areas are enumerated and their value briefly pointed out.

It is believed that the winter pastures in the arid regions may be restored by protection from overgrazing during the season when the native forage plants are producing seed, and by alternately grazing different sections so that part of the range or pasture may remain ungrazed during the winter and in the spring when the young plants begin to grow. Cases are cited which show that improvement of the range can be accomplished by this treatment.

Experiments carried on for 3 years in the Rattlesnake Mountains, where the annual precipitation is 13 in., have shown that bunch grass could be successfully grown on cultivated land, and that alfalfa and hairy vetch are of value for that section. The native grasses, such as bunch wheat grass, proved to be the best forage plants for the region. The author believes that the restoration of badly depleted ranges on the semiarid lands may be hastened by gathering the seed of bunch grass or giant rye grass and reseeding the denuded areas. He suggests that the seed might be either harrowed in or stamped in by sheep herded over the reseeded portions.

The mountain grazing areas or summer pastures, owing to a greater rainfall, are not as difficult of improvement as the semiarid lands. Experiments conducted in these regions for 2 years show that of the number of grasses sown timothy, mountain brome grass (*Bromus marginatus*), tall fescue, and brome grass, in the decreasing order of merit, proved adapted to the conditions. This work further demonstrated the value of harrowing in the seed, and showed that the use of the harrow also had a very favorable effect upon the native grasses and forage plants, especially upon *Bromus marginatus*, *Stipa occidentalis*, and *Vicia americana*.

Alfalfa or lucern, R. A. MOORE, A. L. STONE, and G. A. OLSON (*Wisconsin Sta. Bul. 121, pp. 22, figs. 8*).—A part of the work described in this bulletin has been noted from another source (E. S. R., 16, p. 763). In addition a method of protecting alfalfa with hay caps is given, and the results of comparative tests with alfalfa, clover, timothy, and brome grass, together with a determination of the water, protein, and fat in the green substance and the hay from these crops, are reported.

The total of 4 cuttings of alfalfa gave 32,376 lbs. of green substance, 10,800 lbs. of hay, 8,900 lbs. of dry matter, 1,996 lbs. of protein, and 288 lbs. of fat per acre. The weight of green forage obtained was approximately 2, 3, and 5 times that of clover, timothy, and brome grass, respectively, and the proportions for hay were nearly the same.

The analyses also showed that alfalfa yielded nearly 3 times as much protein per acre as clover, 9 times as much as timothy, and 12 times as much as brome grass, while the dry matter and fat were also greatly in favor of alfalfa. The average protein content in the alfalfa hay was 18.7 per cent and in the green forage 6.4 per cent,

while clover contained 13.28 per cent in the hay and 4.47 per cent in the green forage, timothy 4.47 per cent in the hay and 2.17 per cent in the green forage, and brome grass 6.7 per cent in the hay and 2.7 per cent in the green forage.

A summary of data obtained in tests with alfalfa by members of the Agricultural Experiment Association of Wisconsin shows that of 124 members reporting, 110 advocate sowing with a nurse crop, 99 using oats for this purpose, and 118 favor sowing 2 varieties. As compared with the Turkestan variety common alfalfa is considered best by 28, while 81 could detect no difference. The best rate of sowing as shown by these data is 20 lbs. of seed per acre.

Red clover from various sources, W. M. MUNSON (*Maine Sta. Bul. 113, pp. 28-36*).—A study of red clover from various American and European sources was made in cooperation with this Department in 1902 and 1903.

Germination tests made of all the seed showed that a high percentage of sprouting under favorable conditions, as in a seed tester or on blotting paper, is no proof that similar results will be obtained when the seed is sown in soil. Of the foreign seeds those from Upper Austria, Styria, Hungarian Transylvania, and Russia were apparently the most vigorous, and the American seed from Ohio and Illinois was the strongest.

In 1902, 29 different lots of seed were sown May 19 on plats of 2 square rods each, at the rate of 12 lbs. per acre. The plants began to appear May 26. Those from north European seed were later in maturing than those from seed grown farther south or from American seed. On August 30 the plats sown with seed from Indiana and Bohemia were in good condition for hay. The largest yields were obtained from seed obtained from Minnesota, Bohemia, Indiana, Wisconsin, Brittany, and Ohio, in the order given. The yields of hay per acre for the entire list of tests ranged from 1,040 lbs. for seed from Norway to 4, 040 lbs. for seed from Minnesota and Bohemia.

The shrinkage in curing for hay ranged from 68 to 82 per cent, the average being about 73 to 75 per cent. In 1903 the earliest plats were those from Indiana, Hungarian Mountain Region, and Ohio, being closely followed by plats from Bohemia, Italy, Illinois, and Wisconsin. The earliest plats were ready for cutting June 29. The highest total yield of hay for the season, 3.9 tons per acre, was obtained from Indiana seed, with seed from Bohemia standing second, with a yield of 3.28 tons.

Directions for the breeding of corn, including methods for the prevention of inbreeding, C. G. HOPKINS, L. H. SMITH, and E. M. EAST (*Illinois Sta. Bul. 100, pp. 599-625, figs. 2*).—Experiments to determine the effect of detasseling were carried on for 4 years in connection with corn-breeding work. For 3 years the even-numbered rows on 2 breeding plats containing 44 rows each were detasseled and each succeeding year the even numbered rows were planted with seed selected from the best detasseled rows and the odd-numbered rows with seed selected from the best tasseled rows. Each plat, therefore, contained 22 tasseled rows and 22 detasseled rows, and the seed was saved from the best 10 rows in each lot.

The detasseled rows had no influence upon the breeding of the tasseled rows, but they themselves were necessarily crossbred each year. The tasseled rows, however, in the nature of the case became more or less inbred. The benefits produced by this system of cross breeding are shown in tables; and in addition to general directions for the selection of corn and the management of the breeding plat, a plan for planting to avoid inbreeding is outlined.

Mechanically selected high protein and low protein Leaming corn was grown in these tests. The high protein Leaming showed an average increase in favor of the detasseled rows of 1.6 bu. per acre the first year, 10.1 bu. the second year, and 9.3 bu. the third year, while the detasseled rows of the low protein Leaming yielded 5.9 bu. per acre less than the tasseled rows in the first year of the test and 14.7 and 11.8 bu. per acre more the second and third years, respectively. The individuality of

seed ears was brought out in several instances by the yields of rows located near each other.

In 1902 rows 5 and 7 in the high protein plat produced 74.6 and 86.4 bu. per acre, and in 1904 rows 22 and 24 produced 79.2 and 96.4 bu. per acre, respectively. The results of mechanical selection of corn by different parties showed that in every case a gain was made in the average protein content of the selected ears. The authors recommend planting the breeding plat with the seed from 96 selected ears in 96 separate rows, to detassel completely every alternate row before the pollen matures, and to select all of the seed corn from the 48 detasseled rows. It is advised to allow the tassel to develop sufficiently to be separated alone at the top joint by a careful pull.

The breeding plat according to the proposed plan is divided into quarters, each containing 24 rows and each row representing a separate seed ear. The even-numbered rows are detasseled and 4 ears are selected for seed from each of the 6 best-yielding detasseled rows in each quarter, making 96 ears in all. "It is recommended that these 96 seed ears be numbered from 1 to 48 and from 51 to 98, the numbers 49 and 50 being omitted; also, that ears 1 to 48 be planted in one half of the plat and ears 51 to 98 be planted in the other half, preferably end-to-end with the first half, leaving one hill unplanted to mark the line between the two halves, also leaving one row unplanted to mark the line between rows 24 and 25 and between rows 74 and 75; that is, between quarters."

It is advised, however, to start the first year in the 100 series, numbering the ears to be planted in succession from 101 to 148, and from 151 to 198; the second year from 201 to 248, and from 251 to 298, and so on. The seed ears planted in the odd-numbered rows to produce tassels and to furnish pollen are referred to as "sire seed" and the seed ears for the even-numbered rows, which will contain the mother plants producing the future seed, are called "dam seed." Two of the 4 seed ears taken from each one of the selected rows are used for sire seed and 2 for dam seed.

"The dam seed ears for each quarter are ears which grew in the same quarter, while the sire seed is always brought from another quarter. For the first quarter (rows 1 to 24) sire ears are brought from the fourth quarter. For the second quarter sire seed is brought from the third. In each of these cases sire seed is carried diagonally across the breeding plat. For the third quarter sire seed is brought from the first quarter, and for the fourth, from the second, the sire seed being carried lengthwise of the breeding plat in these cases."

A definite arrangement for the planting of the seed ears in alternate years has been devised to entirely eliminate inbreeding or to bring its influence to a minimum. The order of planting in the even-numbered years is illustrated by considering the first quarter of the plat containing rows 1 to 24, of which numbers 2, 4, 6, 8, 10, and 12 were the 6 best-yielding rows, each furnishing 2 dam seed ears and 2 sire seed ears. The 12 ears of dam seed, bearing the same number as the rows from which they were taken, are used for planting the even-numbered rows of the quarter, the order, beginning with row number 2, being 2, 6, 10, 4, 8, 12, 2, 6, 10, 4, 8, 12, or the alternating even numbers repeated in sets of 3 and 6.

The odd-numbered rows of the quarter are planted with 12 sire ears representing the 6 selected rows of the fourth quarter. The numbers of these rows in the case given are 76, 78, 80, 82, 84, 86, and the order of planting the ears, beginning with row No. 1, is given as follows: 76, 80, 84, 78, 82, 86, 78, 82, 86, 76, 80, 84. The order is the same as for the dam seed ears, with the exception that the two sets of 3 are reversed in the second set of 6. For the odd-numbered years the two sets of 6 in planting the sire seed are transposed, which then makes the order as follows: 78, 82, 86, 76, 80, 84, 76, 80, 84, 78, 82, 86. Exactly the same system is used in each quarter of the breeding plat.

A form for registering the numbers and descriptions of all the seed ears used in corn breeding and also for recording their performance records is given, together with notes on the multiplying plat and the commercial field. Complete directions for describing individual ears are given and a method of keeping the performance record of field rows is illustrated.

The manuring of cotton, G. P. Foaden (*Khediv. Agr. Soc. [Pamphlet] 1, pp. 16, figs. 2*).—The manuring of cotton is described and the effect of the different plant food elements on the growth and development of the plant is pointed out. The results of two different experiments showed that commercial fertilizers were applied with profit. The application used consisted of about 200 kg. of superphosphate, 70 kg. of nitrate of soda, and 30 kg. of sulphate of potash per acre.

Notes on the bacteria active in flax retting, M. W. Beijerinck and A. van Delden (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 6 (1904), pt. 2, pp. 462–481, pl. 1, figs. 4*).—The author discusses the subject of flax retting, which is due largely to the solution and softening of the rind of the flax stock by the removal of the pectose, in consequence of which the bast bundles are separated.

This retting is caused largely by the action of certain bacteria, and may be considered a form of pectose fermentation. Where the retting takes place in the field it is due to the action of various molds, bacteria, and other organisms, and the product is of an unequal character. When, however, it takes place in water the organisms are principally anaerobic bacteria, the chief of which is called *Granulobacter pectinovorum*. The action of this organism and its associated forms is described at length.

Selection of seed potatoes, F. Parisot (*Jour. Agr. Prat., n. ser., 9 (1905), No. 6, pp. 174–176*).—The results of the experiments here reported indicated that the selection of seed potatoes, based on the size, composition, and hereditary characters of the tubers and the number of eyes, is incomplete if no account is taken of a perfectly healthy condition of the seed. Of normal tubers 81.2 per cent produced plants, while of those not perfectly healthy only 41.6 per cent grew. The yield obtained from normal tubers was nearly again as large as from the inferior tubers.

Potato experiments at Parc des Princes, L. Grandeau (*Jour. Agr. Prat., n. ser., 9 (1905), No. 5, pp. 141, 142*).—Fertilizer experiments in 1904 with Thomas slag and Cierp phosphate, and either one of these substances in combination with nitrate of soda, sulphate of ammonia, and lime nitrogen are reported.

The phosphatic fertilizers were given in quantities furnishing 200 and 300 kg. of phosphoric acid per hectare, the larger quantity being applied in 1902 and the smaller being given in 2 equal portions, one in 1902 and the other in 1904. The nitrogenous fertilizers supplied 45 kg. of nitrogen per hectare. All plats had received a dressing of 200 kg. of potash per hectare.

The smaller application of Thomas slag produced a heavier yield than the larger quantity, but in the case of Cierp phosphate the larger application gave the heavier yield. The yields for the 2 phosphatic fertilizers taken together show the best results from the use of 200 lbs. of phosphoric acid per hectare. The plats receiving Cierp phosphate produced on an average 1,536 kg. of tubers per hectare less than the plats receiving Thomas slag. The yields on plats given nitrate of soda, sulphate of ammonia, and lime nitrogen were 11,258, 10,771, and 10,545 kg. per hectare, respectively. An average yield of 5,499 kg. per hectare was obtained on the check plats.

The degeneration of potatoes, P. Ehrenberg (*Landw. Jahrb., 33 (1904), No. 6, pp. 859–915, dgms. 4*).—This article discusses at some length the degeneration of potato varieties as possibly due to continued propagation by means of the tubers, to unfavorable local conditions, and to poor selection of seed tubers. The literature on the subject as well as experiments along this line are reviewed.

The author concludes that in all probability the age of a potato variety is not a factor in its degeneration, but that unsuitable environment, especially a poorly

adapted soil and insufficient care in the selection of seed tubers, are strong factors in reducing the vigor of a variety.

The degeneration of potato varieties, R. Tuckermann (*Mitt. Landw. Inst. Breslau, 3 (1904), No. 1, pp. 1-92, dgms. 5*).—The subject is considered from a cultural and a physiological standpoint and the conclusions drawn are based on the results of numerous experiments by different investigators.

The degeneration of varieties is considered as largely due to cultural and local conditions, while the superiority of new varieties over older sorts is regarded as indicating a greater adaptability to the particular region. Physiological degeneration of a variety is not believed to result from the asexual method of propagation through a series of years.

The fact that certain old varieties in particular localities retain their productiveness, in the opinion of the author, would seem to contradict such a conclusion. It is stated that a study of the principal factors of growth, especially climatic conditions in each locality, would throw much needed light upon this subject.

Commercial sugar-beet seed, J. E. W. Tracy (*U. S. Dept. Agr. Rpt. 80, pp. 177-183*).—The importance of good sugar-beet seed is discussed, and the work of establishing a pedigree strain of sugar-beet seed, carried on in connection with the New York State, the Michigan, and the Utah experiment stations and with private growers at Holland, Mich., and Fairfield, Wash., is described.

The work was begun by securing the best strains of European seed and also all known strains of American-grown seed and growing them for comparison. Of these the best 4 strains were selected as foundation stocks, and all beets of exceptional quality were saved and planted the next spring as mother beets for seed production. In 1904 one-half of the seed secured from these individual plants was planted and the best specimens of beets preserved for the production of the first crop of elite seed. The other half of the seed will be planted this year and from the beets produced the next year's supply of elite seed will be grown.

It is reported that during the last year a Washington State sugar-beet seed grower produced a lot of some 300 roots testing 21 per cent or more of sugar in the beet, with composite tests showing coefficients of purity ranging from 86 to 91.9. In this lot were included 15 roots containing 24 per cent, 50 with 23 per cent, and 100 with 22 per cent of sugar in the beet. Results of variety tests of sugar-beet seed from American and European growers in 1904 show a range of from 15 to 17.7 per cent of sugar in the beet and a range in coefficient of purity from 83.7 to 87.9. The low as well as the high figures were secured in Kleinwanzlebener sugar beet from American-grown seed. The highest yield per acre, 13.17 tons, was obtained from Kleinwanzlebener seed grown at Fairfield, Wash.

Last year this Department distributed some 4,000 lbs. of California-grown and 11,000 lbs. of Washington-grown Kleinwanzlebener sugar-beet seed, in order to compare it with the seed furnished to farmers by the factories. Of the reports so far received, 73 per cent of those planting Washington-grown seed and 63 per cent of those planting the California-grown seed found it to be of quicker, stronger, and healthier germination, and none found it inferior to the other seed. The returns from 561 acres showed that the sugar content of the beets from the Washington-grown seed was 15.4 per cent and from the California-grown seed, 14.4 per cent, as against 14.9 per cent for beets from the factory seed. The Washington seed yielded 10.7 tons, the California seed 9 tons, and the factory seed 9.1 tons per acre.

Single-germ beet seed, C. O. Townsend (*U. S. Dept. Agr. Rpt. 80, pp. 161-166, figs. 2*).—This article covers part of the work published in Bulletin 73 of the Bureau of Plant Industry of this Department, which has been previously noted (E. S. R., 16, p. 983).

Fertilizers and sugar beets, C. O. Townsend (*U. S. Dept. Agr. Rpt. 80, pp. 167–176*).—A general discussion on the use of green manure, stable manure, and commercial fertilizers in beet culture is presented and results obtained under different conditions with different kinds of fertilizers are reported.

The climatic conditions are shown by data taken from the monthly weather reports of the stations at Detroit, Mich.; Spokane, Wash., and Omaha, Nebr. The experiments were conducted in these localities. A comparison was made of two complete applications, the one consisting of 125 lbs. of dried blood, 100 lbs. of sulphate of potash, and 275 lbs. of South Carolina rock, and the other of a complete fertilizer containing 1 to 2 per cent of ammonia, 4 to 5 per cent of potash, and 8 to 10 per cent of phosphoric acid, applied at the rate of 325 and 200 lbs. per acre.

The amount received per acre for the beets shows an increase, apparently due to the fertilizer, ranging from 27 cts. to nearly $30. Each application proved highly profitable in two of the experiments and failed to increase the yields sufficiently to pay for the fertilizers used in the two other tests. In one case a low rainfall is considered as accounting for the small increase due to the fertilizers.

In another series of tests 300 lbs. of nitrate of soda per acre gave a large increase in the value of beets per acre. Applying one-half the quantity just before planting and one-half July 1, gave results a little better than when the entire quantity was applied just before planting. The quality of the beets did not seem to be affected. In studying the effect of different amounts and different combinations of fertilizer elements on sugar beets it was found that good results were obtained in each experiment by using 200 lbs. of nitrate of soda, 200 lbs. of phosphoric acid, and 100 lbs. of sulphate of potash per acre.

The results also seemed to indicate that the potash had no appreciable effect on the quantity or quality of the beets. None of the salts applied showed any injurious effect upon the quality. In one experiment common salt was applied at the rate of 200, 300, and 500 lbs. per acre. The result seemed to indicate a beneficial effect in helping the soil to retain moisture. In some instances there was no effect upon the yield, and in others 200 lbs. seemed as effective as 500 in increasing the tonnage. The heavier application did not appreciably affect the quality of the beets.

Variety tests with sugar and fodder beets, J. Hansen and K. Hofmann (*Deut. Landw. Presse, 32 (1905), Nos. 18, pp. 151, 152; 19, p. 163*).—The average yields of 11 varieties of sugar beets, each grown on 2 plats, ranged from 43,090 to 48,230 kg. per hectare, the best yielder among them being the Friedrichswert variety.

In average sugar content in the beet the varieties varied from 19.19 to 21.71 per cent in the Friedrichswert and Heine varieties, respectively. In average yield of sugar per hectare Schreiber Zuckerreichste stood first with 9,638 kg., and Rabethge and Gieseke Late Klein-Wanzleben last with 8,661 kg. The coefficient of purity in the different varieties varied from 88.35 in Friedrichswert to 92.61 in Schreiber Klein-Wanzleben. The test with fodder beets also included 11 varieties.

In productiveness Criewen Eckendorf stood at the head of the list with a yield of 79,320 kg. of beets per hectare, and Tankard Mangold, obtained from England, last with a yield of only 38,870 kg. The continental climate, and especially the dry summer, proved detrimental to the 2 English varieties grown in this test. The Eckendorf, Tannenkrug and Leutewitz varieties, given in the decreasing order of yield, ranked next to the Criewen Eckendorf variety in the production of beets. A heavy yield of leaves was not correlated with a heavy yield of beets.

The percentage of dry matter was quite high, ranging from 11.67 per cent in the Tannenkrug beet to 17.50 per cent in the Substantia Lank variety. In yield of dry matter the Leutewitz variety led with 10,755 kg. per hectare, followed by Substantia Lank and Oberndorf, each producing more than 10,000 kg. These varieties also stood in the same rank and order in the yield of sugar. The percentage of sugar

varied from 7.69 in Yellow Mangold, one of the English varieties, to 10.14 in Substantia Lank.

The experiment with fodder beets again called attention to the fact that the most productive varieties as a rule are low in dry matter and food value, which their greater yield does not always counterbalance.

Progress of the beet-sugar industry in the United States in 1904, C. F. Saylor (*U. S. Dept. Agr. Rpt. 80, pp. 1-160, pls. 4*).—This report is a general review of the successes and failures of the year, and a discussion of the influences and conditions acting on the development of the beet-sugar industry.

Beet sugar is now produced in 12 States, in 4 of which irrigation is practiced. In 1904, 48 factories and 4 slicing stations were in operation. The factories were distributed as follows: Michigan 16; Colorado 9; California 5; Utah 4; Nebraska, Idaho, and Wisconsin 3 each; and Minnesota, New York, Ohio, Oregon, and Washington 1 each. Three factories in California and 3 in Michigan were not operated during the year, and 3 plants were in the process of construction. In discussing the mistakes made and the obstacles met and overcome, the author considers the supply and character of labor, the competition with favored crops, the requirements of sugar-beet culture different from those of other crops, the influence of bad seasons, diseases and insects, the use of poor seed, and the methods of establishing factories.

During the year 4 large factories were installed in new localities, 2 in Wisconsin and 2 in Idaho. One of these factories is new, while the others are old ones removed from other localities. The development of conditions and prospects for new factories are discussed by States. In considering climatic conditions and farm and factory results for 1904 for the different beet-growing States, the author points out the methods of handling a crop of sugar beets, and calls attention to the injury done by hail and rain during early growth.

A field of beets, hailed and flooded out on June 27, was given a deep cultivation as soon after the rain as the soil conditions permitted, and the beets were straightened up with hand and hoe. On July 23 this field had fully recovered, showing healthful growth with abundant foliage. This crop yielded 16 tons per acre with high sugar content and purity. The statistics for the year show that 197,784 acres of beets were harvested, the average yield per acre being 10.47 tons. The total quantity of beets worked was 2,071,539 tons, and the quantity of sugar manufactured, 484,226,430 lbs. The beets had an average sugar content of 15.33 per cent and an average purity coefficient of 83.09.

The employment in the sugar-beet fields of young boys coming under the jurisdiction of the juvenile court in Denver, Colo., is discussed; and a description of the most improved methods of growing sugar beets is republished from a previous report.

Beet-sugar factories of the United States and Canada (*Amer. Sugar Indus. and Beet Sugar Gaz., 7 (1905), No. 11, p. 254*).—This is a list which gives the location and daily capacity of 7 factories in California, 9 in Colorado, 3 in Idaho, 17 in Michigan, 2 in Nebraska, 1 in New York, 1 in Ohio, 1 in Oregon, 4 in Utah, 1 in Washington, 3 in Wisconsin, and 3 in Canada, 4 not in operation, and 6 now building for the campaign of 1905.

The beet-sugar industry of Wisconsin, F. W. Woll (*Wisconsin Sta. Bul. 123, pp. 70, figs. 8*).—This bulletin briefly considers the manufacture of sugar from beets grown in Wisconsin, presents statistical and other information on the present condition of the industry, summarizes previous work, and reports the results of the more recent investigations at the station and in different parts of the State.

A summary of analyses of 2,994 samples of sugar beets grown by Wisconsin farmers from 1890 to 1901, inclusive, shows an average sugar content in the juice of 14.13 per cent, with an average purity coefficient of 78.6. The average yield is estimated at 14.8 tons per acre. In experiments at the university farm from 1890 to 1904, inclu-

sive, the average sugar content of the beets secured was 14.10 per cent. The average yields of beets and sugar as calculated amounted to 17.37 tons and 4,900 lbs. per acre, respectively.

According to the report on Wisconsin beet-sugar factories for 1904–5, 125,928 tons of beets, containing an average of 14.4 per cent of sugar with an average purity of 83.7, were worked. The total acreage in 1904 was 14,400. Reports on 75 culture tests in 1904 give information concerning methods of culture and show that, on an average, 2.8 acres of beets were grown in each test, the average sugar content in the beets being 15.1 per cent; the yield, 16.5 tons per acre; the net receipts, \$70.57, and the average expense, \$29.09 per acre.

Brief notes on the individual experiments and discussions on the soil and culture requirements of the crop are given. The expense of growing an acre of beets is considered and compared with the cost of growing cereals, potatoes, and tobacco. The fertility removed by different crops and the influence of a preceding crop on the yield and quality of beets are shown in tables. The text of contracts in force between the factory and the grower is given.

Culture of tobacco, G. M. Odlum (*London: British South Africa Co., 1905, pp. 185, pls. 8, figs. 101*).—A treatise on the culture of tobacco, in which the different phases of the production, preparation, and marketing of the crop are discussed. In addition to treating of the tobacco plant and its varieties in relation to soil, climate and cultural operations, its insect enemies, diseases, methods of curing, buildings for curing, grading, and fermenting the leaf, packing and marketing the product, and miscellaneous topics are considered. The book is a report on tobacco culture based mainly on an investigation of the tobacco industry in America.

Report on tobacco investigations in Wisconsin for 1903 and 1904, E. P. Sandsten (*Wisconsin Sta. Bul. 124, pp. 45, figs. 13*).—This bulletin is a report on work in the improvement of Wisconsin tobacco seed, on fertilizer experiments, and on growing Sumatra tobacco under cover. A preliminary report has been previously noted (E. S. R., 16, p. 68).

In addition to the experiments previously reported, fertilizer tests were made in 4 other localities. The soils and conditions were unlike, and the results are applicable only to the particular localities in which the work was carried on. At Rio and Westby the use of commercial fertilizers gave a smaller yield than that of barnyard manure. Early in the season the plats receiving commercial fertilizers showed the best growth, but later they were overtaken and outstripped by those receiving barnyard manure.

At Soldier's Grove on sandy-loam soil in a high state of cultivation commercial fertilizers gave better results than barnyard manure, the greatest gain, 508 lbs. per acre, or 36 per cent, being secured from the plat receiving 300 lbs. of nitrate of soda per acre. The plat treated with 200 lbs. each of nitrate of soda and sulphate of potash per acre gave a smaller yield than the barnyard-manure plat, the manure having been applied at the rate of 20 tons per acre. The results at Janesville were not conclusive on account of the poor physical condition of the soil at planting. The cost of commercial fertilizers and their influence on the burning quality of tobacco is discussed.

Experiments in growing Sumatra tobacco under cover were conducted in 1902 and 1903. Directions are given for tent construction, the culture of the crop, and its fermentation. The total cost of growing 2 acres of Sumatra tobacco in 1902 and 1903 was \$3,395.03, and the total net receipts were \$1,681.27, or a net profit of \$420.32 per acre per year. The total yield of fermented tobacco was 2,314 lbs. in 1902 and 2,110 lbs. in 1903, which was sold at prices ranging from 50 cts. to \$2 per pound.

Tobacco investigations in Porto Rico during 1903–4, J. van Leenhoff, Jr. (*Porto Rico Sta. Bul. 5, pp. 44, pls. 5, fig. 1*).—The methods of tobacco growing now practiced in Porto Rico are described.

The results of experiments in growing, curing, and fermenting tobacco are reported, and ways and means for the improvement of the Porto Rican crop are suggested. Mechanical analyses of soils and subsoils from typical Porto Rican tobacco fields, as determined by the Bureau of Soils of this Department, are given in tables and discussed. The mechanical analyses of subsoils from 2 Cuban tobacco districts are also given.

In seed-bed experiments it was found that the seed under shade came up from 2 to 4 days earlier than the seed without shade; but while the shaded seeds came up earlier and looked healthier during the first 3 weeks, those without shade were finally more vigorous and larger. The shade reduced evaporation, resulting in a quicker and more perfect germination of the seed, and also protected the beds from washing. Cloth was more satisfactory for shade than straw.

The burrows of changas in the seed bed were treated with a solution of 1 part of kerosene to 14 parts of water, and no further depredations were noticed. When the plants suffered from disease a dilute solution of Bordeaux mixture was applied with very beneficial results.

Transplanting experiments were made outside and under cover. In the open mamey and mango leaves were used for shading. The petiole of the leaf was stuck into the ground 1 to 2 in. south of each tobacco plant to shield it from the direct rays of the sun during the hottest part of the day. Of 445 plants protected in this way 125 died, and of the same number of unprotected plants 300 failed to grow. At harvest the shaded plants showed a much greater uniformity in growth than the unprotected ones. Of 300 plants wrapped in mamey leaves as a protection against cutworms and mole crickets 200 died, and of the same number unprotected 220 had to be replanted. Wrapping the plants is a protection against the crickets, but it is often detrimental to early growth because it confines the upper roots of the plant and allows water to collect within the leaf.

The poor results in these two experiments were largely due to insufficient care in planting and the use of unselected seed. In a trial under cheese cloth only about 5 per cent of 1,700 carefully set-out plants failed to grow, while in a plat of 800 plants planted in the usual native way the loss was much greater.

An experiment in shade-growing wrapper leaf suffered from delays and disease attacks, but the results of this test as well as those of a second experiment indicated "that shading increases the yield, quality, and percentage of wrappers sufficiently to make shading a profitable business, providing it is practiced only on soils suitable for growing wrappers and the crop is given the best of care throughout its growth and further treatment in curing and fermentation."

Fertilizer experiments carried on at Aibonito showed that on that particular soil acid phosphate was more efficient than sulphate of potash or nitrate of soda combined. The 3 substances were applied at the rate of 60, 20, and 20 lbs. per acre, respectively. The use of 200 lbs. of lime in addition to the complete application showed no improvement. In another test 2,000 lbs. of cotton-seed meal produced a better growth, especially in the young plants, than a liberal dressing of compost of horse manure and vegetable matter, including tobacco stems. The use of fertilizers for tobacco in Porto Rico is discussed.

Curing experiments were made in 3 curing sheds, the first a frame building constructed for a storehouse, the second a shed of poles and canvas covered by a straw roof, and the third a large shed constructed of board sides with a thatched roof on a pole framework. The daily temperature and relative humidity were ascertained in each shed from March 19 to April 23.

In the frame building, with a mean temperature of 80.2° F. and relative humidity of 68.3 per cent, the tobacco dried too quickly and the leaves when cured contained many green spots. In the cloth shed the temperature was at first much too high and the tobacco was badly damaged, but when the mean temperature was down to

78.26°, with a relative humidity of 70 per cent, the conditions for curing were more favorable than in the frame building. The best results were obtained in the large shed with a mean temperature of 77.67° and a relative humidity of 73.57 per cent. The slightly lower temperature and higher relative humidity in this shed were apparently more favorable to securing the best results.

Fermentation investigations were made and the temperature records of one pile of outside-grown tobacco with a high percentage of wrapper leaves are shown in a table. The suggestions for the improvement of Porto Rican tobacco include discussions regarding soil, seed and seed beds, time and method of transplanting, cultivation, topping, harvesting, curing, and fermentation.

Extermination of Johnson grass, W. J. SPILLMAN (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 72, pt. 3, pp. 14, pls. 3, figs. 4*).—The results of investigations begun in 1902 for the eradication of Johnson grass, which is one of the most troublesome weeds in the Southern States, are given. These investigations are still in progress, but some definite results have been secured that seem to justify the publication of the data already at hand.

From the experiments already carried on it seems feasible to eradicate Johnson grass in a single year by plowing in the autumn, care being taken to turn the soil completely. After plowing the land should be harrowed immediately, so as to get it smooth and well pulverized, after which it is given treatment by root diggers, which tear out and collect the roots. In the spring the land should be plowed again and put in cotton, giving it ordinary good tillage. All plants of Johnson grass that remain should be pulled out by hand, and by repeating this whenever the grass gets about 6 in. high it can be eradicated during a single summer without an excessive amount of labor. These directions apply to cultivated fields and are not practicable along fence rows, ditch banks, etc.

HORTICULTURE.

Summary of experiments in practical horticulture, W. M. MUNSON (*Maine Sta. Bul. 113, pp. 21-27*).—A brief summary is given of the results of experimental work at the station, since its establishment, in the culture of vegetables, ornamentals, and fruits, including spraying.

With the tomato it has been found that earliness and productiveness stand in direct ratio to the earliness of setting in the field. Under favorable conditions the plants should be in the field by June 1. The yield has been increased a third by trimming the plants after a part of the fruit has set. Bagging the fruit has reduced the loss from rot. Crossing between early small-fruited prolific varieties and the common large-fruited ones has resulted in types well suited to seasons of short growth and for forcing under glass.

The increased yield of the Lorillard-Peach cross over the pure Lorillard has been nearly 50 per cent. Seed from plants grown under glass has in some instances given better results in forcing than seed of the same variety grown in the field. The results were not uniform, however, and there appear to be distinct varietal differences.

Cabbage plants handled 2 or 3 times before setting in the field have invariably given better results than plants handled but once or twice. Depth of setting has had very little influence on the size of the head produced by "leggy" plants. Trimming the plants at time of setting in the field has not been of apparent benefit. Handling the plants in pots before setting in the field has increased the percentage of marketable heads. Mulching has been found a very satisfactory substitute for cultivation for this crop.

Cauliflower plants handled in pots have made a more uniform growth and produced a higher percentage of marketable heads than when grown in boxes. Trim-

ming the plants has had no beneficial effect. Better results have been secured from frequent cultivation than from mulching. The most valuable sorts for culture appear to be Dwarf Erfurt and Snowball types, with Algiers for late in the season.

Early varieties of eggplants can be successfully grown in Maine, the requisites for success being early sowing, vigorous plants, late removal to the field, and warm, rich soil. Several crosses have been made between white-fruited and black-fruited types, but nothing of permanent value has been produced. The white-fruited types appeared to be stronger than the purple in their power to transmit form and productiveness.

In the case of radishes, 30 to 50 per cent more first-class roots have been secured from large seed than from small seed of the same lot. Subwatering increased the yield of first-class radishes 12 to 15 per cent in the greenhouse over surface watering. The loss from damping off was also greater on the surface-watered beds than on the subirrigated. The crop matured earlier and was of better quality when grown with a night temperature of 60° than when grown at a lower temperature.

In greenhouse work it has been found that one good man with occasional help should be able to do all the work in houses covering 4,000 sq. ft. of ground surface. "In general, solid beds are advocated for plants requiring no bottom heat, such as cauliflower, lettuce, and radishes, while for semitropical plants, like melons, beans, and tomatoes, benches are preferred." Steam heat for large houses and hot water for small houses are recommended.

Relative to fruit growing, it is believed that the opportunities in this line are greater than in any other line of commercial horticulture in Maine. With apples it has been found that in the case of the Gravensteins the number of trees producing some fruit was nearly 50 per cent greater when cultivation was practiced than when the land was mulched, while the average yield was as 72 and 59, respectively. The use of potash in different forms as a preventive of apple scab has given only negative results. Cultivation has had a marked beneficial effect in the renovation of the orchards.

In spraying experiments the amount of wormy fruit has been decreased by the use of arsenicals. Paris green has injured foliage less than London purple or white arsenic. While a pound of Paris green to 250 gal. of water reduced the amount of wormy fruit, a strength of a pound to 100 gal. of water was required to kill the tent caterpillar. Spraying with Paris green greatly lessened the number of windfalls and the proportion of wormy fruit among the windfalls.

With the larger part of the wormy fruit from sprayed trees the wormholes were at the side or base of the fruit, while in the case of fruit from unsprayed trees more worms entered at the calyx end. Three applications of ammoniacal solution of copper carbonate proved sufficient to control the apple scab fungus and resulted in saving 52 per cent of the crop, though the foliage and fruit were slightly injured. The most satisfactory and effective fungicide, however, is the Bordeaux mixture.

The improvement of blueberries by crossing, selection, etc., is under way at the station.

In the plant-breeding work evidence has been obtained which indicates that "the secondary results of crossing may be of fully as much importance as are directly inherited qualities. Among these secondary effects are the possible immediate influence of pollen upon the mother plant; the stimulating effect of pollen upon the ovary, and the influence of varying amounts of pollen."

Report of the Upper Peninsula Substation for 1904 [Horticulture], L. M. GEISMAR (*Michigan Sta. Spec. Bul. 31, pp. 23-36*).—A detailed account is given of experiments at the station in the culture and tests of a number of varieties of garden peas, beans, sweet corn, cucumbers, muskmelons, watermelons, tomatoes, cabbage, cauliflower, celery, onions, leeks, salsify, kale, collards, lettuce, spinach, radishes,

scolymus, globe artichoke, mustard, roquette (*Eruca sativa*), rampion (*Campanula rapunculus*), parsley, tobacco, peppers, sunflowers, and a number of flowers and honey plants. Similar notes are also given for strawberries and orchard fruits.

Nott Excelsior has proved the best of the medium early varieties of peas. Edible ears of Peep O'Day sweet corn planted June 10 were obtained September 1. Earliest of All was the next earliest variety. Vaughan Earliest of All is the most promising variety of tomato thus far tested. The husk tomato (*Physalis francheti*) was not killed by frosts until November and came up the following May from underground runners.

Extensive observations relative to the onion maggot indicate that it does not propagate in the wild leek, nor in the cultivated leek, nor on perennial onions. In onion sets which were shipped in from the outside 22 out of 26 onions contained 2 to 8 maggots each. Cedar birds were especially injurious in eating and destroying strawberries. Robins were less so. Their depredations were restricted to "the gathering of the seed from a few berries, and this only at a time when their young begin to feather out."

A number of orchard trees were injured by sun scald during the winter above snow line. Seven varieties which ripened fruit were Haas, Borowinka, Gideon, Hibernal, Patten Greening, Yellow Transparent, and Duchess.

Asparagus culture in California, R. E. SMITH (*California Sta. Bul. 165, pp. 5-18, figs. 13*).—This bulletin is primarily a report to certain asparagus growers, canners, and dealers in California, who provided a fund of $2,500 for investigating asparagus rust. That part of the bulletin dealing with the nature and control of asparagus rust is noted elsewhere in this number.

The commercial culture of asparagus in California has developed largely within the last 10 years, principally in the delta country between Sacramento, Stockton, and Port Costa. At present about 7,000 acres of asparagus are grown annually in California. The crop is grown on 2 classes of soils, sedimentary river deposits and island peat soils. In small field culture the rows may be as close as 5 ft. apart, but in the great island plantations they are 9 or even 10 ft. apart and about 2 ft. distant in the row. For canning purposes the blanched stalks are grown. These are produced by ridging dirt high up over the rows.

In marketing, the crop is trimmed to a uniform length of 7 in. and packed in bulk in 60-lb. boxes. Bunching is not practiced except to a limited extent and for shipment to eastern markets in a fresh condition. The average yield is placed at 5,000 lbs. of merchantable asparagus per acre, while good fields in prime condition may produce 7,000 to 8,000 lbs. without fertilization. The larger part of the crop is canned. The author states that the process of canning is clean and appetizing, "and the product healthful and delicious, being immeasurably superior to fresh asparagus bought in the market and cooked at home."

Tomatoes, L. C. CORBETT (*U. S. Dept. Agr., Farmers' Bul. 220, pp. 32, figs. 13*).—Popular directions are given for growing and marketing tomatoes, the subject being considered from the standpoint of tomatoes as a field crop at the North, as a field crop at the South, forcing of tomatoes, and the tomato as a field crop for canning.

Pruning tomatoes, W. T. MACOUN (*Country Gent., 70 (1905), No. 2720, p. 250*).—Two varieties of tomatoes were used in the experiment, Sparks Earliana and Matchless.

When the plants had developed 6 strong leaves in the hotbed the tops were nipped off and the plants given more room, being spaced 5.5 in. apart each way. "The object of pinching off the top of the plant was to cause new shoots to develop at the axils of the leaves, in order to have 6 branches bearing early tomatoes instead of the one cluster usually found on the top of the plant." These plants were set out in the field June 6 alongside of other plants which were left unpruned. On June 22

one-half of the pruned plants were again pruned, all laterals being taken out and the 6 main branches only being left. The remaining plants were left to grow at will.

The first ripe fruit on the unpruned plants was secured July 29, on the plants pruned once August 13, and on those pruned twice August 12. The heaviest yield of fruit was obtained from plants pruned twice in the case of the Sparks Earliana and pruned once in the case of Matchless. In both cases the pruned plants gave much heavier yields than the unpruned plants. The results are thought to be very promising and market gardeners are advised to give this system of pruning a trial.

A few notes on ginseng, M. HARRINGTON (*Trans. Iowa Hort. Soc., 39 (1904), p. 276*).—The author states that from beds of ginseng 40 ft. long and 5 ft. wide, including the path between the beds, he secured $55 worth of dried root and $16 worth of roots for replanting the bed. He believes that had he dried all the roots the cash value would have been at the rate of about $15,000 per acre. From one-seventh of an acre about $1,850 worth of ginseng seed was produced in 1903. In 1904 the same patch produced over 600,000 seed with an estimated value of $3,000 or at the rate of $21,000 per acre.

Planting-table for vegetables, E. L. FULLERTON (*Gard. Mag. [New York], 1 (1905), No. 3, pp. 110–113*).—A tabulated guide is given showing when and how to plant and cultivate 74 kinds of vegetables. Such matters as the depth to plant seeds and roots, distance apart, time required for the crop to mature, the use of the crop, etc., are included. The table is adapted to the use of those who make small home gardens which are cultivated by hand or by the wheel hoe.

Report on culture experiments carried out in 1904 on the sewage fields of Berlin, J. KLAR and O. MENDE (*Gartenflora, 54 (1905), No. 1, pp. 14–19*).—A general account is given of the results secured during the year in the growth of a number of flowers and of such vegetables as radishes, salad plants, tomatoes, cauliflower, and potatoes, including the swamp potato (*Solanum commersonii*). With reference to the latter it is stated that on account of the small yield of tubers obtained this potato at present can be designated only as "interesting."

The higher standard in American horticulture, G. T. POWELL (*West. N. Y. Hort. Soc. Proc. 1905, pp. 64–73*).—A number of suggestions are made relative to improved methods of fruit propagation, orchard management, harvesting, and marketing fruits to meet the better class of trade, special emphasis being given to the adaptation of soil to variety, the labeling of packages which shall give full information to purchasers as to the quality of the fruit and the best method of preparing it for the table, the improvement of soil, the improvement of trees through selection, and the need of organized effort in marketing fruits.

The progress of fifty years, L. H. BAILEY (*West. N. Y. Hort. Soc. Proc. 1905, pp. 6–14*).—The progress which has been made along different lines of fruit culture during the past fifty years, in methods of orchard management and the handling and marketing of fruit, is discussed.

Report of South Haven Substation for 1904, T. A. FARRAND (*Michigan Sta. Spec. Bul. 30, pp. 30*).—The usual account is given of the behavior of the varieties of fruits and nuts tested at the South Haven Substation, with further results of spraying experiments with different fruits and the use of cover crops (E. S. R., 16, p. 260).

The severity and length of the winter resulted in a loss of many peach trees from root freezing. In experiments at the station and in cooperation with a number of farmers, tests were made of the relative efficiency for scale insects of the lime-sulphur-salt mixture, made according to the usual directions, made without salt, or made with caustic soda substituted for the salt, in comparison with caustic soda and lime.

The results of these experiments indicated that the use of 6 lbs. of caustic soda and 5 lbs. of lime diluted with 50 gal. of water is without benefit in the control of the scale, while a stronger solution is dangerous to both man and beast. The lime and sulphur seem to be the elements in the mixture which destroy the scale. The addi-

tion of copper sulphate, caustic soda, and other materials is an added expense and gives no better results.

The usual method of mixing ingredients and boiling was found to be the most satisfactory way for preparing the wash. Experiments with this mixture on peaches showed that it is perfectly safe to spray on peach trees up to the time the blossoms open. The use of copper sulphate has again been found the most satisfactory method of controlling peach-leaf curl. It can be controlled equally well by the use of lime-sulphur-salt wash, but the latter is much more expensive and unless it is required for the scale should not be used.

Fall applications of the lime-sulphur-salt wash, copper sulphate, and Bordeaux mixture were compared with spring applications of these same fungicides. The spring applications gave slightly better results. In order to test the effect of a thick coating of lime as a protection for peach buds over winter they were heavily sprayed with whitewash in the fall. Neither beneficial nor injurious effects could be observed from the application. In the experiment 8 lbs. of salt was added to each 50 gals. of wash. The coating of whitewash and salt was without effect as regards leaf curl.

Experiments in the fall pruning of peach trees indicated that the heading in of the trees in late fall and early winter if continued may result in serious injury. Dust sprays proved inefficient in the control of apple-scab fungus and of pear leaf blight and scab.

In order to test the recommendation of a California fruit grower that crude petroleum could be used as a spray while the foliage was on if followed within 15 to 20 minutes with a solution of concentrated lye, a test was made in June. Six trees were sprayed on one side with petroleum. Immediately thereafter 2 of the trees were sprayed with a solution of 1 lb. concentrated lye dissolved in 9 gal. of water. Two other trees were sprayed with a solution of 1 lb. of caustic soda to 9 gals. of water, and the 2 remaining trees with 1 lb. of crude potash to 9 gals. of water. The foliage was killed whereever the oil was used. The trees were also seriously injured and many of the smaller branches killed. The caustic solutions also slightly burned the foliage but not sufficently to cause it to fall off.

A number of trees were treated by the Owen process for the control of insect pests and diseases. The treatment consisted of boring a hole into the heart of the tree, putting in a grayish black powder composed largely of sulphur and charcoal and then putting in a wooden plug. Up to the present time this treatment has proved entirely valueless, as was expected.

Japanese chestnuts at the station are proving of but little value. Two of the European varieties, Paragon and Comfort, are very promising and have given several noteworthy crops. In the test of cover crops in the orchard mammoth clover has proved especially valuable. It is most satisfactory when oats or barley are grown with it.

Pomology as a study, R. L. CASTLE (*Jour. Roy. Hort. Soc.* [*London*], *29* (*1904*), *No. 1-3*, *pp. 146-160*).—A paper showing the wealth of material which fruits furnish to students who wish to study them for pleasure or information. Specific suggestions are given for study and investigation along the following lines: (1) Flower-bud formation, controlling influences such as food supply and weather; (2) problems in fertilization and sterility; (3) the development of fruits; (4) fruit characters and description; (5) systems of classification.

Under flower-bud formation the author notes an experiment in root pruning 6 espalier pear trees which had made a very free growth but which were still unfruitful. Two trees were root pruned on both sides, 2 on one side only, and the remaining 2 were left untouched for controls. The root pruning was performed in January and February and nothing special was noticed during the current year.

The following year the trees root pruned on one side only produced a fair crop of good fruit; those more severely root pruned had very few fruits, while those which

had not been root pruned at all were unfruitful as usual. One of the latter trees was root pruned later and gave results similar to the earlier root-pruned trees.

In discussing the subject of fertilization and sterility, the author states that practically all varieties of strawberries in England, with the possible exception of the Hautbois type, bear both stamens and pistils, while in America many of these varieties are distinctly pistillate. Crescent Seedling is cited as a specific example. This variety, which is perfect in England, is generally pistillate in the United States.

The staminate portion of flowers has generally been held to be more easily injured than the pistillate portions, but this has not been found by the author to be the case with our principal fruits when the temperature falls below the freezing point. Under those circumstances the pistil and stigma are more quickly injured, though something depends upon the stage the flower has reached. But even with small unopened blossoms of apples, pears, peaches, apricots, plums, cherries, gooseberries, currants, and strawberries, the pistils have repeatedly been found destroyed when the stamens showed no damage. The greatest injury to stamens appears with sudden variations, especially from a low temperature to a high one with abundant moisture.

The author's observations indicate that "pollen production is the most serious tax upon the strength of the tree, and in consequence in the case of weakness or soil poverty the stamens or anthers are the first to suffer" This has been noticed in the apples Stirling Castle, Lord Suffield, and Cox Orange Pippin, and others, besides several plums, pears, and peaches. "In such cases sterility has been effectually removed by liberal application of complete manurial aids; but where the defect has arisen from some other cause it has been necessary to plant other varieties with the failing sorts in order to provide the requisite pollen."

Under systems of classification examples are given of a number of methods which have been adopted by English writers in classifying and describing fruits, with comments on the usefulness and defects of the different systems.

Plant food constituents used by bearing fruit trees, L. L. VAN SLYKE, O. M. TAYLOR, and W. H. ANDREWS (*New York State Sta. Bul. 265, pp. 205–223*).—Experiments were undertaken to ascertain the amounts of nitrogen, phosphoric acid, potash, lime, and magnesia used in one growing season by bearing fruit trees.

From 1 to 3 standard varieties each of apple, peach, pear, plum, and quince were examined. All the trees were typical representatives of their kind and in the full vigor of bearing. The plan of the work included the analysis of the fruit, leaves, and new growth of wood as represented by the tips of branches of each individual tree. A number of tables are given which show the data collected in the case of each tree as regards the plant-food constituents of the fruit, leaves, and new wood.

The varieties of apples used in the experiment were Rhode Island Greening and Baldwin; of peaches, Champion, Elberta, and Hills Chili; of pears, Kieffer and Angouleme; of plums, Grand Duke and Italian Prune; and of quinces, Champion. The fruit on the different trees was picked when ripe. The foliage was left until it showed a tendency to drop. The twigs of new wood were removed soon afterwards.

The following table shows the average amount of plant-food constituents used by each fruit tree of the different varieties studied:

Plant food used during a season's growth by a mature fruit tree in full bearing.

Variety.	Nitrogen.	Phosphoric acid.	Potash.	Lime	Magnesia.
	Pounds	*Pounds.*	*Pounds*	*Pounds.*	*Pounds.*
Apple	1.47	0.39	1.57	1.62	0.66
Peach	.62	.15	.60	.95	.29
Pear	.25	.06	.27	.32	.09
Plum	.25	.07	.32	.34	.11
Quince	.19	.06	.24	.27	.08

It may be determined from this table "that the relative proportions of the different plant-food constituents are approximately the same for these different varieties of fruit trees. This means that under like conditions of soil fertility a mixture of nitrogen, phosphoric acid, and potash which would meet the requirements of one variety would also meet the needs of the other varieties, so far as the supply of these plant-food constituents is concerned."

In some years fruit trees bear no fruit. It is, therefore, desirable to know the amounts of food constituents used by different parts of the tree. The following table gives these data:

Amounts of food constituents used per acre by different parts of a tree.

Part of tree.	Nitrogen.	Phosphoric acid.	Potash.	Lime.	Magnesia.
Fruit:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Apple	20.0	8.5	45.0	3.9	6.4
Peach	17.5	8.6	36.0	2.2	4.1
Pear	9.0	3.2	20.2	2.2	2.6
Plum	13.3	4.7	18.5	4.4	3.0
Quince	22.0	10.0	44.4	3.4	6.0
Average	16.4	7.0	32.8	3.2	4.4
Leaves:					
Apple	30.3	4.8	9.5	49.7	16.3
Peach	50.4	8.0	32.9	94.6	28.5
Pear	18.5	3.0	10.7	30.7	7.2
Plum	13.2	2.9	17.6	26.8	8.5
Quince	20.4	4.1	9.8	46.1	11.0
Average	26.6	4.6	16.1	49.6	14.3
New wood:					
Apple	1.1	.4	.6	3.0	.6
Peach	6.6	1.6	3.4	17.4	2.6
Pear	2.2	.8	2.0	5.4	1.1
Plum	3.0	1.0	1.8	10.0	1.5
Quince	3.1	1.2	2.6	16.1	1.9
Average	3.2	1.0	2.1	10.4	1.5

The above table is calculated on the basis of 35 apple, 120 peach, 120 pear, 120 plum, and 240 quince trees per acre in each instance. An acre of peach trees uses considerably larger quantities of plant food than any of the other varieties of fruit trees. The amounts of the nitrogen and potash required per acre in the case of the different fruit trees are practically the same, while the amount of phosphoric acid used is only about one-fourth as much as of nitrogen or potash.

"In most commercial fertilizers used on fruit trees the phosphoric acid is present in proportions about 4 times the nitrogen. This is on the assumption that the soil contains more nitrogen relatively than phosphoric acid, which may or may not be true in individual cases. The question may be raised as to whether quantities of phosphoric acid are not frequently applied much in excess of the actual need of a season's crops. . . .

"In respect to the amounts of plant food used per acre by the fruit of the different varieties of trees, the amounts of nitrogen, phosphoric acid, and potash in the different fruits are in about the following order: Quinces use the most, and then follow apples, peaches, plums, and pears.

"Potash is present in the fruit in larger quantities than is any other plant-food constituent; nitrogen comes second, being present to the extent, approximately, of one-half the amount of potash. Then follow, in order, phosphoric acid, magnesia, and lime, all of these being present in much smaller amounts.

"In the leaves, the plant-food constituents used per acre are greatest in the case of the peach, the apple coming second, and then quince, pear, and plum.

"Lime is present in the leaves and also in the new wood in much larger quantities than any other plant-food constituents; nitrogen comes second, followed in order by potash, magnesia, and phosphoric acid.

"In the new wood, the plant-food constituents used per acre are greatest in the case of the peach trees, after which come in order quince, plum, pear, and apple."

Tabulated analyses showing amounts of plant-food constituents in fruits, vegetables, etc., L. L. Van Slyke, O. M. Taylor, and W. H. Andrews (*New York State Sta. Bul. 265, pp. 223-230*).—Analyses with reference to moisture content, nitrogen, phosphoric acid and potash, which have been accumulating at the station, are here brought together for a large number of fruits and vegetables.

The list includes apples, blackberries, cherries, currants, dewberries, gooseberries, grapes, peaches, pears, plums, quinces, raspberries, strawberries, asparagus, string beans, beets, cabbages, carrots, cauliflower, cucumbers, eggplant, lettuce, mushrooms, muskmelons, onions, parsnips, garden peas, pumpkins, radishes, rhubarb, salsify, sweet corn, tomatoes, turnips, watermelons, balm, dandelion, endive, horehound, hyssop, peppermint, pot marjoram, prickly comfrey, rose bushes and foliage, rue, sage, tansy, tarragon, thyme, winter savory, and wormwood.

Observations on the phenology of plants at Ames, Charlotte M. King (*Trans. Iowa Hort. Soc., 39 (1904), pp. 114-137, pl. 1, dgm. 1*).—Tabular data are given showing the blooming period of a large number of species of plants, including flowers and fruits, at Ames and other parts of Iowa for 1904 and in some instances for other years between 1886 and 1904. A bibliography of a number of papers on the phenology of plants is included.

Varieties of fruits in Thurgau in the year 1903, F. Schwyzer-Reber (*Mitt. Thurgau. Naturf. Gesell., 1904, No. 16, pp. 3-61*).—An account of the different varieties of orchard fruits now grown in Thurgau, with a statement of the condition of orchards in different sections based on replies to a letter of inquiry sent out to growers.

New York apples, S. A. Beach (*West. N. Y. Hort. Soc. Proc. 1905, pp. 44-53*).—A historical account is given of early orcharding in New York and of the introduction of Russian varieties and of the varieties of fruits that are now in the lead in New York.

Phases of orchard management in Wayne County as discovered by an orchard survey, J. Craig (*West. N. Y. Hort. Soc. Proc. 1905, pp. 54-64, figs. 6*).—In a fruit survey which was made in Wayne County it was found that the average yield of apples for 4 years in orchards where the trees were planted 30 ft. apart each way was 184 bu. to the acre. When the distance between the trees ranged from 31 by 31 to 35 by 35 each way the average yield was 222 bu. per acre and when the distance ranged from 36 by 36 to 40 by 40 ft. each way the yield averaged 229 bu. per acre.

Imperfect drainage was found to be a frequent cause of failure, in whole or in part, in many western New York orchards. The matter of ownership appeared to have an important bearing on productiveness of orchards. The average yield in orchards managed by the owners was 210 bu. per acre and in rented orchards 174 bu. per acre. There was also a considerable difference in the yield from sprayed and unsprayed orchards.

In 66 sprayed orchards the average yield was 280 bu. per acre and the selling price $2.02 per barrel, while 107 unsprayed orchards yielded at the rate of 253 bu. per acre and sold at an average price of $1.80 per barrel. These figures indicate a difference of about $14.84 per acre in favor of spraying. The trees were sprayed only once or twice, rarely three times, and no special effort was made to make it thorough and efficient.

The apple in Oregon, II, E. R. Lake (*Oregon Sta. Bul. 82, pp. 37, figs. 11*).—Part I in this series of bulletins (E. S. R., 16, p. 368) dealt with the history of apple

culture in Oregon, selection and planting of the trees, soil, and location of the orchard. In the present bulletin the subjects discussed are the varieties of apples for home use, pollination, cultivation, cover crops, and pruning.

In discussing the effect of soil and season on pollination the author states that the self-fertility of the Italian prune is considerably affected by these factors. Some years in western Oregon and western Washington orchards bear full crops in all sections. In other years only a few orchards bear, or one orchard may bear in a locality while all the others are barren.

The relation between the blooming periods of different varieties of apples has been found to vary considerably in Oregon in different seasons and localities. The period from first bloom to full bloom also varies in different seasons. Thus, "in 1896, Delaware Red and Dominie were in full blossom 17 days apart, but in 1897 they were in full blossom only 2 days apart." The time intervening between the period of first and full bloom in the case of Fameuse one year was 7 days, another year 3 days, another 12 days, another 9 days, another 14 days, and another 8 days. In one locality the Yellow Newtown bloomed 2 days before Northern Spy, while in another locality Northern Spy bloomed 5 days before Yellow Newtown. A table is given showing the period of first blossom, full blossom, and the fall of blossom, respectively, for 110 varieties of apples grown in the State for each of 7 years.

Hairy vetch appears to be a very satisfactory orchard cover crop in Oregon. In the discussion of pruning special attention is called to the losses among prunes as a result of injudicious pruning at setting-out time. The prunes are set out usually in the late fall or early winter and cut back to mere stubs, which exposes a large wound. These wounds should be painted over with white lead in which has been dissolved a little sulphate of copper.

In western Oregon fruit on low-headed apple trees is often of indifferent color, while that on trees of medium to high heads is of fair to high color. For this reason the author suggests that trees of late fall and winter varieties be headed or trained high in that section, while summer or early fall varieties may be headed low if desired.

The presence of abnormal quantities of starch in bruised apples, G. VARCOLLIER (*Cidre et Poiré, 1904, Aug.; abs. in Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 5, pp. 578, 579*).—While ripe apples contain little if any starch, bruised apples were found to contain large amounts in the vicinity of the bruise. This injures their value for cider making, as the starch is not converted into sugar.

Experiments in girdling fruit trees, J. E. MAY (*Pract. Fruit Grower, 11 (1905), No. 195, p. 11*).—The author ringed a number of 8-year-old apple trees which had not borne fruit. The following seasons both ringed and unringed trees bloomed full. Soon, however, the blossoms on the ungirdled trees showed signs of blasting and within a few weeks there were scarcely any apples on them, "while on the girdled trees the blooms stayed and set large quantities of fruit, which hung on well and colored very much more than on the other trees."

In one instance a girdled York tree produced 9.5 bu. of fruit, while an ungirdled tree alongside produced but 1 bu. Attention is called to the necessity of carefully observing the trees after they have been girdled to see that the wound is healing over properly.

The olive tree; its geographical distribution and historical and agricultural importance, T. FISCHER (*Mitt. Justus Perthes' Geogr. Anst., Ergänzungsh, 147, pp. 87, map 1*).—There are 2 main divisions of this pamphlet. One deals with the history of the olive, its botany, cultural requirements, diseases, varieties, oil production, etc., and the other with the culture of olives in the different countries of the world, especially those districts bordering on the Mediterranean Sea.

The book of topiary, C. H. CURTIS and W. GIBSON (*London and New York: John Lane, 1904, pp. VIII + 80, pls. 34*).—The history is given of this method of training

plants, with directions for the management of topiary gardens and the training of young and old trees in this work. This is the eighteenth volume in the series of handbooks of practical gardening, edited by H. Roberts.

The effects produced by grafting or budding various kinds of fruit trees on different kinds of stocks, R. P. SPEER (*Trans. Iowa Hort. Soc., 39 (1904), pp. 249–252*).—During the period from 1866 to 1897 the author conducted a nursery and made extended observations on the interrelation of stock and scion with a number of different kinds of fruit, particularly apples. Some of these observations are recorded.

A wonder-worker of science. An authoritative account of Luther Burbank's unique work in creating new forms of plant life, W. S. HARWOOD (*Cent. Mag., 69 (1905), Nos. 5, pp. 656–672; 6, pp. 821–837, figs. 37*).—Descriptions are given of the many new forms of fruits, flowers, nuts, and other economic plants created or improved by Mr. Burbank, with an account of his methods of work. A fuller account of the spineless cactus and its fruits is given than has appeared heretofore.

Breeding grapes to produce the highest types, T. V. MUNSON (*Nebr. Farmer, 37 (1905), No. 12, p. 315*).—A paper read by the author before the American Breeders' Association, February 1, 1905.

The grape and its development, J. C. BLAIR (*Trans. Ill. Hort. Soc., n. ser., 38 (1904), pp. 412–427*).—A paper on this subject in which the manufacture of unfermented grape juice and the food value of the grape are discussed in addition to cultural methods.

The assimilation of phosphoric acid by grapes, E. ZACHAREWICZ (*Prog. Agr. et Vit. (Ed. l'Est), 25 (1904), No. 43, pp. 459–462*).—Experiments were made to determine what influence the use of superphosphates would have on the phosphoric acid content of the fruit and wine.

Physical and chemical analyses are given of the soils on which the experiments were carried out and the usual experimental details recorded. The amount of superphosphate used on the different plats varied from none on the control plat to 45, 90, and 135 kg., respectively, on the other 3 plats. The analyses of wines made from the grapes grown on the different plats showed that there was 10 times as much phosphoric acid in the wine from the plat which had been fertilized with 135 kg. of superphosphate as from the control plat.

The conclusion is drawn that phosphoric acid may be accumulated in part in fruit and contribute its beneficial influence to the wine made from it.

Planting-table for flowers, L. BARRON (*Gard. Mag. [New York], 1 (1905), No. 3, pp. 117, 118*).—Brief suggestions are given on the making of flower beds, planting and sowing of flowers, as well as a table showing when and how to sow 47 different kinds of flowering plants, period of flowering of the plants, and color of the flowers, with notes on soil, water, transplanting, etc.

On the hybridization of the genus Rosa, M. VIVIAND-MOREL (*Jour. Roy. Hort. Soc. [London], 29 (1904), No. 1–3, pp. 38–46*).—A brief treatise on this subject considered largely from an historical standpoint.

Pansy culture, W. TOOLE (*Trans. Ill. Hort. Soc., n. ser., 38 (1904), pp. 130–135, pl. 1*).—The author describes his methods of commercial outdoor pansy growing in Wisconsin.

FORESTRY.

A primer of forestry. II, Practical forestry, G. PINCHOT (*U. S. Dept. Agr., Bur. Forestry Bul. 24, pt. 2, pp. 88, pls. 18, figs. 47*).—Part 1 of this primer (E. S. R., 11, p. 855) dealt with the units which compose the forest and the character of the forest as a whole.

The present part deals with the practice of forestry, with the practical work in the woods in perpetuating forests and in lumbering, with the relation of forests to

weather and streams, and gives a short account of the historical development of forestry and of present forestry practices in foreign countries and in the United States.

Forestry experiments, F. W. RANE (*New Hampshire Sta. Bul. 119, pp. 51–68, figs. 8*).—A discussion is given of the prevalence and value of native pine seedlings, with an account of experiments in the digging, packing, and transplanting of pine seedlings and a comparative statement of the cost in reforesting with wild seedlings and nursery-purchased stock. Two earlier bulletins along similar lines have been published by the station (E. S. R., 14, p. 873; 16, p. 56).

In most sections of New England where the white pine (*Pinus strobus*) is native young natural seedlings in large numbers occur. The author urges the use of these in reforesting. The cost of digging and packing 2-year-old seedlings when moderately thick is placed at 75 cts. per 1,000, and is based on actual experiments by students at the station. One man can pack for shipment 20,000 of these seedlings in half a day. The Boston market bushel box has been found a very satisfactory package for shipment. One man under favorable conditions can transplant about 400 seedlings per hour.

The cost of setting the plants 8 by 8 ft. is placed at about 50 cts. per acre. If set 5 by 5 ft. the expense would be about $1.50 per acre. The total expense of digging and transplanting wild seedlings amounts to approximately $1.50 per 1,000. Early spring is considered the best time for transplanting pine seedlings. Seedlings not less than 2 nor more than 4 years old are recommended.

If a nursery stock is used for reforesting the expense will be considerably increased. In the station work the cost was $3 per 1,000 and 100,000 were used to cover an area of 43 acres. The cost for packing was $20, and the expense of planting in the nursery row and then transplanting, use of land, culture, etc., amounted to $280. The total cost, therefore, averaged about $14 per acre, which is considerably in excess of the cost when native seedlings were transplanted from the forest.

The shade trees of Denver, W. PADDOCK and B. O. LONGYEAR (*Colorado Sta. Bul. 96, pp. 14, pls. 13*).—Directions are given for the culture of shade trees in Colorado with descriptions of about 60 kinds of trees which are foreign to the State, but which are known to be growing in Denver.

The principal shade trees of Colorado are the cottonwood and box elder. These trees are popular because they are successfully grown under conditions of partial neglect. It is believed, however, that many other desirable varieties can be successfully grown if proper attention is given to details of planting and caring for the trees. Owing to the drying winds of winter it is believed that the best time for planting trees in Colorado is in the spring of the year.

Shade trees and ornamental shrubs and plants, G. MCCARTHY (*Bul. N. C. Dept. Agr., 26 (1905), No. 1, Sup., pp. 33–36*).—A list is given of deciduous flowering shrubs desirable for planting in the upland region of North Carolina.

The planted groves of Iowa, H. P. BAKER (*Proc. Iowa Park and Forestry Assoc., 4 (1904), pp. 36–45*).—Suggestions are given for the planting of different species of trees in Iowa and an account of different groves which have been planted for a number of years in different sections of the State.

Groves of Norway spruce at Conroy, Iowa, have made an average growth of 1 ft. 9 in. per year for the last 15 years. Two areas at Conroy were measured and the number of posts and poles ascertained. One area was estimated to have a value of $145.62 per acre and the other $144.04 per acre, giving an average annual gain since the groves have been planted of $8.04. With corn at 20 cts. per bushel the average annual gain per acre is $7.

What the college has done for park and forestry during the last thirty years, L. H. PAMMEL (*Proc. Iowa Park and Forestry Assoc., 4 (1904), pp. 51–70*).—An account is given of the different plantings of trees that have been made under the direction of college authorities at Ames during the past 30 years. A list is given

of the trees on the campus with dates when planted, character of the soil and subsoil in which they are growing, circumference of the trees in inches, height, and general remarks on the character and the culture given.

Our mountain chaparral, G. ROBERTSON (*Pacific Rural Press, 69 (1905), No. 21, pp. 324, 325*).—An account of the chaparral belts of San Bernardino, with descriptions of the principal species of shrubs growing in each of these belts, and practical suggestions regarding the preservation of chaparral belts.

Layering rubber trees, H. N. RIDLEY (*Agr. Bul. Straits and Fed. Malay States, 3 (1904), No. 11, pp. 441, 442, pls. 2*).—An illustration is given of a number of rubber trees that have grown from the trunks of trees blown down in a storm.

It is recommended that trees that are blown down in storms be laid prostrate on the earth and banked up along the fallen trunk about halfway and the top of the tree cut off. Shoots spring up along the tree in abundance, but should be thinned out until only about 8 are left.

Two little-kown caoutchouc-producing lianes, E. DE WILDEMAN (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 8, pp. 515–517*).—The author states that for a long time it was supposed that the caoutchouc exported in large quantity from tropical Africa was obtained from a single liane, *Landolphia florida*. Recent researches, however, have shown that caoutchouc from *L. florida* is not exported by the natives for this purpose.

The caoutchouc is mostly derived from two other species, *Baissea gracillima* and *Periploca nigrescens*. The latter seems to be the more important of the two. Caoutchouc from Periploca is black and of good quality. This liane is not very large. The stem is about as thick as the thumb and covered with a scaly bark. It produces seeds abundantly whose germination is not injured by the voyage from Africa to Belgium. The plant is also easily propagated by cuttings. Sprouts from the roots may be exploited commercially after 2 years' growth.

DISEASES OF PLANTS.

Report of the plant pathologist, E. MARCHAL (*Bul. Agr. [Brussels], 21 (1905), No. 1, pp. 73–80*).—During the season covered by this report the author investigated about 150 different plant diseases, a list of which is given. Notes are also given on a number of the more characteristic diseases and suggestions presented for their prevention.

Report of the consulting botanist, W. CARRUTHERS (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 258–269, figs. 2*).—A report is given of the investigations carried on by the consulting botanist for the year 1904. During this time a considerable number of samples of grass and clover seed were examined, and species of plants as well as diseases of the same were determined.

In connection with the diseases of plants investigated, notes are given on the economic habits of a number of fungi, none of which appears to be entirely new.

Concerning the root rot of cotton, V. MOSSERI (*Sur un pourridié du cotonnier. Cairo: Impremerie Nationale, 1904, pp. 22, pls. 2*).—A description is given of the root rot of cotton which has been attributed to *Ozonium auricomum*. The author believes that the disease in Egypt is different from that in the United States; at least it is not believed by him to be due to the above-named fungus as observed in Europe and which is believed by many authors to be an incomplete form of some hymenomycete.

Various methods of treatment are suggested, and among those considered most promising, the author calls attention to the securing of immunity by selection of plants. This is applied particularly in the case of cotton and banana, both of which are subject to the disease.

Some diseases of the potato, G. MASSEE (*Jour. Roy. Hort. Soc. [London], 29 (1904), No. 1–3, pp. 139–145, figs. 6*).—Brief descriptive notes are given of the potato rot

(*Phytophthora infestans*), winter rot (*Nectria solani*), black scab (*Œdomyces leproides*), bacterial disease (*Bacillus solanacearum*), and potato scab (*Sorosporium scabies*). The effect of these different fungi on the host plants is described, and so far as known the methods of distribution, infection, and means of control are given.

Potato spraying experiments in 1904, F. C. STEWART, H. J. EUSTACE, and F. A. SIRRINE (*New York State Sta. Bul. 264, pp. 95–204, pls. 16, map 1*).—In continuation of the 10-year spraying experiments for the control of potato diseases (E. S. R., 14, p. 875; 15, p. 781), a report is given of the operations carried on by the station during 1904.

The bulletin gives the details of 58 experiments in different parts of the State, in which increased yields of potatoes due to spraying are reported. At Geneva 5 sprayings increased the yield by 233 bu. per acre, while 3 sprayings gave an increase of 191 bu. At Riverhead the gain due to 6 sprayings was 96¾ bu. and to 3 sprayings 56½ bu. per acre. At this place the flea beetle was the principal enemy.

In the experiments carried on by farmers in different parts of the State, gains of 62¼ bu. per acre are reported in one series including 180 acres. This gain was made at an average cost of \$4.98 per acre, and the net profit, based on the market price of potatoes at digging time, was \$24.86 per acre. In another series of experiments carried on with 41 farmers throughout the State, including 363¾ acres, the average gain due to spraying was 58½ bu. per acre, the net profit received being \$22.01 per acre.

Different fungicides were tested in these experiments, soluble Bordeaux mixture and soda Bordeaux being compared with Bordeaux mixture made with lime after the usual formula. The results obtained were in favor of the use of the lime Bordeaux, as previously described. It is believed that the efficiency of the soluble Bordeaux mixture may have been reduced by the use of too dilute a solution.

The authors state that the practice of spraying potatoes for the control of blight is on the increase in New York, and many growers are preparing to spray who have hitherto disregarded this precaution. For 1905 the regular experiments will be continued at Geneva and Riverhead, and efforts made to extend the work through volunteer cooperative investigations.

Profits from spraying potatoes, F. H. HALL ET AL. (*New York State Sta. Bul. 264, popular ed., pp. 16, figs. 3*).—This is a popular summary of the above bulletin.

Notes on Cobb's disease of sugar cane, E. F. SMITH (*Centbl. Bakt.* [*etc.*], *2. Abt., 13 (1904), No. 22–23, pp. 729–736*).—The author gives the results of a study of a disease of sugar cane which was first recognized in Australia by N. A. Cobb (E. S. R., 7, p. 513). The disease is accompanied by a copious exudation of gum, and on this account is sometimes called the gum disease of sugar cane.

The author investigated the cause and behavior of the disease, concluding that it is of bacterial origin and due to the organism previously described but which by the present system of nomenclature becomes *Pseudomonas vascularum*. The organism was separated and grown in various media, after which successful inoculation experiments were carried on.

Attention is called to the resemblance between this disease and its cause and that which is known as the sereh disease of sugar cane in Java.

A bacterial wilt disease of tobacco, Y. UYEDA (*Centbl. Bakt.* [*etc.*], *2. Abt., 13 (1904), No. 9–11, pp. 327–329, figs. 3*).—A bacterial disease of tobacco is described which has been under observation at the experiment station at Tokyo, Japan, and which is attributed to attacks of *Bacillus nicotianæ*. The disease is said to cause much injury, especially when the transplanting is made late in the season.

Prolonged moist weather followed by a high temperature favors the development of the disease, which is characterized by a wilting and yellowing of the lower leaves, followed by a blackening of the stem and leaves and finally of the roots. The natural infection seems to take place through the roots, but the author believes that it may also occur through wounds caused by topping or suckering of the plants.

The bacteria have been isolated and cultivated on a number of media, their characteristics being described. It is believed by the author that this disease is the same as that reported under the name of the Granville wilt in North Carolina (E. S. R., 15, p. 684).

In a postscript the author states that experiments have shown the possibility of communicating the disease through the stomata, the characteristic blackening being observed in 8 days on plants whose leaves were sprayed with a solution containing the bacteria.

A Sclerotinia disease of tobacco, C. A. J. A. OUDEMANS and C. J. KONING (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 6 (1903), pt. 1, pp. 48–58, 85, 86, pls. 2*).—A report is given on a disease of tobacco noted as occurring injuriously in the tobacco fields of Holland.

A study of the disease showed that it was due to a hitherto unknown fungus, to which the name *Sclerotinia nicotianæ* is given. It is said that the common practice in growing tobacco is to divide the fields into small areas by means of hedges of scarlet runner and other beans, the object being to protect the tobacco plants against wind by the high, dense growth of the beans. An examination showed that the disease was most prevalent near these hedges, and to the dampness and shading of the hedges are attributed the conditions necessary for the development of the fungus.

Plants affected by the fungus show limp, slippery leaves and discolored stems. If leaves of this character are carried to the curing shed, the fungus quickly spreads through the entire curing house. The authors separated the fungus and give its technical description, and as means for preventing its attack suggest that the use of the bean hedges should be abandoned and wherever the diseased leaves and stems are observed they should be removed and burned. When putting the tobacco leaves in the drying sheds they should be well separated and all suspected leaves should be destroyed.

The study of the diseases of some truck crops in Delaware, C. O. SMITH (*Delaware Sta. Bul. 70, pp. 16, pls. 2, figs. 6*).—The author describes the leaf spot of cucurbits caused by *Sphærella citrullina*, a leaf spot of eggplant due to *Ascochyta lycopersici*, and a leaf spot of beans and cowpeas which is attributed to the fungus *Phyllosticta phaseolina*.

The leaf spot of cucurbits was abundant during the autumn of 1903, the author finding it quite common on the leaves and fruit of squashes and pumpkins and to a limited extent on the leaves of cucumbers and cantaloupes. The fungus is of special interest on account of its resemblance to a disease reported as destructive to watermelons in Delaware (E. S. R., 5, p. 787). The author describes the gross and microscopic characteristics of the fungus, and gives the results of artificial cultures and inoculation experiments. He describes the different stages of the fungus, which in the perfect stage is designated as *Sphærella cucurbitacearum*, although the name adopted in the text of the bulletin is *S. citrullina*. This last combination would be displaced if strict attention to priority should be paid.

The leaf spot of eggplants is due to the fungus *Ascochyta lycopersici*, the different stages of which are described. The possible relationship between this fungus and *Phyllosticta hortorum* is pointed out, and the writer believes them to be identical. Inoculation experiments have shown that this fungus successfully attacks the eggplant, tomato, horse nettle, and jimson weed. A brief account is given of a Septoria attacking the fruit of the eggplant, and it is believed to be possibly an immature form of the Septoria occurring on tomatoes.

The leaf spot of beans and cowpeas caused by *Phyllosticta phaseolina* is described at some length. This trouble was first observed on Lima beans, but it has since been found on other varieties of beans and also on cowpeas, being particularly destructive to Lima beans and cowpeas wherever these plants are grown in Delaware. The

fungus is described at some length. By inoculation experiments it was found possible to transfer the organism from one variety of beans or cowpeas to another.

No work is being carried on for the control of these diseases by spraying, but the author believes that Bordeaux mixture properly applied would give beneficial results. An additional suggestion is offered that all diseased vines be collected and burned at the end of the season, so as to remove danger of infection as much as possible.

Asparagus rust in California, R. E. SMITH (*California Sta. Bul. 165, pp. 1-7, 18-99, figs. 33*).—This bulletin gives the results of continued investigations on the asparagus rust (E. S. R., 16, pp. 66, 986).

The previous results have shown that by careful attention to cultural methods and the relation of moisture to the development of the fungus the disease could be controlled to a considerable extent. Continued studies have shown that the rust can be almost completely controlled in California through careful attention to cultural methods and the use of treatments which are described at considerable length.

In 1904 an extended series of experiments was inaugurated to test the efficiency of sulphur, both as a liquid spray and as dry powder, for the control of the fungus causing the rust. These experiments are described at length. Summarizing the results the author states that sulphur either in dry or liquid form, acting largely by its gaseous fumes, is a satisfactory rust preventive when properly applied. It is shown that this treatment can be applied economically and practically in any of the districts covered by the investigations.

The use of contact sprays failed to give good results, but of those used resin Bordeaux was best and soap Bordeaux nearly as good. In general no spraying method should be resorted to until rust control by cultural means has been carried as far as possible, and it is probable that without reasonable attention to cultural methods the best of spraying will prove a failure.

The methods for the application of dry sulphur, time of treatment, amount of sulphur required, and the relative efficiency of different kinds of sulphur are discussed at some length, the cost of material and application being estimated at from $5 to $6 per acre for 2 applications during the season. Where the sulphur spray is used it is said to have some advantages and be more efficient, a single application being considered the most effective single treatment for the rust.

Brief notes are given on the rust parasites and on some of the insects affecting the asparagus plant.

Black rot of cabbage, W. BRENNER (*Centbl. Bakt. [etc.], 2. Abt., 12 (1904), No. 22-24, pp. 725-735, figs. 6*).—The author has investigated the black rot of cabbage and allied plants, and in the main agrees with Smith and Harding regarding the occurrence in Europe of this disease, its cause, and methods of infection (E. S. R., 9, p. 847; 12, p. 654).

The organism *Pseudomonas campestris* was isolated and studied in various media. Inoculation experiments produced the characteristic appearance of the disease in from 14 to 21 days. The relation of insects to infection was studied, and the author concludes that infection can take place only through wounds or through the water pores along the margins of the leaves.

A bacterial disease of cauliflower and allied plants, F. C. HARRISON (*Centbl. Bakt. [etc.], 2. Abt., 13 (1904), Nos. 1-3, pp. 46-51; 5-7, pp. 185-198, pls. 6*).—This is practically a reprint of Ontario Agricultural College and Experimental Farm Bulletin 137 (E. S. R., 16, p. 480).

Notes on a disease of cucumbers, P. MAZÉ and H. T. GÜSSOW (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 270-272*).—A description is given of an apparently undescribed disease of young cucumbers, which covered the fruit with a thick dark olive-green mass of hyphæ. In the specimens observed by the authors the portion

of the fruit next the stalk was little injured, while the distal portions were greatly reduced in size and killed by the parasite. The leaves showed no trace of disease.

An examination of the fungus on the part of the second author has led him to the conclusion that it is an entirely undescribed one, and he proposes for it the name *Corynospora mazei* n. g. and n. sp.

From the nature of the disease the authors recommend the use of a dilute solution of copper sulphate or other fungicide, and also the collection and burning of all débris about the places of cultivation.

Apple scab and cedar rust, R. A. EMERSON (*Nebraska Sta. Bul. 88, pp. 21, figs. 9*).—This bulletin while describing apple scab and cedar rust is intended principally to record observations showing the results of tests of spraying as a means for preventing these diseases. Brief descriptions are given of the appearance of the two diseases, and attention is called to the varying susceptibility of different varieties of apples to both these diseases.

Spraying tests were carried on with 6 varieties for the prevention of the apple scab and the rust, the fungicide used being a 4:4:50 solution of Bordeaux mixture. The results obtained showed that spraying reduced the proportion of rusted leaves, and the effect as shown on the yield of fruit indicates that the spraying was very beneficial in reducing the amount of scab. The rust was held in check even on the varieties that are ordinarily badly rusted.

The first application of Bordeaux mixture should be made when the so-called apples on cedar trees are becoming gelatinous and orange colored, followed by such applications as are needed, usually a second spraying after an interval of 10 days or 2 weeks. In addition to spraying the apple trees the removal of the cedar trees for a considerable distance about orchards or, where this is impossible, the cutting out and destruction of the cedar apples is recommended.

In experiments for the control of apple scab the 2 sprayings recommended for this purpose practically coincide in time with those suggested for the control of the rust. Some slight difference is noted in the efficiency of later applications for the prevention of the scab.

Apple and pear scab, M. C. COOKE (*Jour. Roy. Hort. Soc. [London], 29 (1904), No. 1-3, pp. 91, 92*).—Notes are given on the apple and pear scab (*Fusicladium dendriticum* and *F. pirinum*), the habit, external appearance, life history, development, and remedies for which are practically the same, the only difference being those of a microscopical character.

The author describes the effect on the host plant, and gives some estimates as to the injury caused by the fungi, after which an account is given of the methods by which the fungus is carried over winter, and the discovery of the perfected form (*Venturia inæqualis*) is noted. For the prevention of injury by the fungi the author recommends thorough spraying of the trees with Bordeaux mixture or modified eau celeste.

The brown or bitter pitting of apples, G. QUINN (*Jour. Agr. and Indus. So. Aust., 8 (1905), No. 6, pp. 305-309*).—Attention is called to what is apparently a physiological disorder of apples, which goes under the name of brown or bitter pitting.

This disease has been known in southern Australia for at least 20 years, and is characterized by the appearance at first of small, dark-green, depressed areas on the skin of the apple, beneath which the pulp cells become dull brown, dry, of a spongy nature, and dead for several layers of cells in depth. The most noticeable development of this pitting seems to follow the formation of sugar as the apple approaches ripeness.

A careful examination of diseased specimens failed to show any fungus or other organized cause for the disease. Marked differences are reported for different varie-

ties of apples. Based upon the observations of the author and others, it is believed that the pitting is due to unsuitable conditions of soil, moisture, and temperature, either separately or in combination.

To prevent the occurrence of the disease as much as possible, the author suggests that susceptible varieties should not be planted, and that planting on damp, rich soil should be avoided. Care should be taken in pruning, and the use of fertilizers should be given attention, so as to produce the most favorable growth of the trees.

A fruit disease caused by Fusarium putrefaciens n. sp., A. Osterwalder (*Centbl. Bakt. [etc.], 2. Abt., 13 (1904), Nos. 5-7, pp. 207-213; 9-11, pp. 330-338, pls. 2*).—A rot of apples and pears is described which is attributed to attacks of *Fusarium putrefaciens* n. sp.

The fungus was isolated, and inoculation experiments showed the readiness with which the disease could be produced on pomaceous fruits. The characteristics of the fungus and its effect on the fruits of the apple and pear are described at length. The author claims that the fungus is identical with that reported by Eustace as *Cephalothecium roseum*, which causes a rot of apples (E. S. R., 14, p. 1088). He agrees with Eustace and others on the ability of this fungus to cause a rotting of the fruits, in this way refuting the claims of a number of European investigators. The fungus, which is technically described, is believed to be a phase of the species previously noted.

Notes on canker and gummosis of fruit trees, J. Brzeziński (*Centbl. Bakt. [etc.], 2. Abt., 12 (1904), No. 19-21, pp. 632-640*).—A controversial article, in which the author criticises some of the conclusions of Aderhold regarding the relation between canker and gum flow of fruit trees, which the latter attributes to attacks of *Clasterosporium carpophilum* (E. S. R., 15, p. 591).

A new disease of figs (*Jour. Agr. and Indus. So. Aust., 8 (1904), No. 5, pp. 266, 267*).—A brief account is given of a disease of figs which is said to be caused by attacks of Botrytis. So far as observed only the Capri figs are attacked. The young wood will put out new leaves and fruit in the spring, but before they attain any considerable size they begin to droop and finally die. The fungus appears to be carried over in the Capri figs, the peduncle or stalk of the fruit being the point of attack.

Spraying has so far proved of little value in combating the disease, and the removal of the winter figs would involve in one case the loss of the crop and in the other the destruction of the fig insect, which is needed for the fertilization of the fruit.

Wither-tip and other diseases of citrus fruits, P. H. Rolfs (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 2, pp. 25-34*).—This is largely a reprint of a bulletin by the author which has been previously noted (E. S. R., 15, p. 974). It is claimed that the wither-tip, caused by *Colletotrichum glœosporioides*, has been recently observed as occurring in Jamacia on limes.

Notes on the Glœosporium disease of red currants, R. Laubert (*Centbl. Bakt. [etc.], 2. Abt., 13 (1904), No. 1-3, pp. 82-85, fig. 1*).—The author gives an account of the distribution of the Glœosporium disease of currants in Europe and elsewhere, showing the effect produced upon the host and giving technical descriptions of the fungus, particular attention being paid to a number of its forms.

The present aspect of the epidemic of the American gooseberry mildew in Europe, E. S. Salmon (*Jour. Roy. Hort. Soc. [London], 29 (1904), No. 1-3, pp. 102-110, map 1*).—The author describes the distribution of the gooseberry mildew (*Sphærotheca morsuvæ*) in Europe, and states that it occurs in epidemic form in Ireland and Russia, and has been reported as observed in other localities.

Notes are given on the efforts which have been made to control the disease in a number of localities, and the author recommends the continued and thorough application of fungicides, together with the pruning and burning of affected portions of the bushes.

Fungus diseases of the cranberry, C. L. Shear (*U. S. Dept. Agr., Farmers' Bul. 221, pp. 16, figs. 11*).—The cranberry is affected by 4 serious fungus diseases known as blast, scald, rot, and anthracnose.

The first 2 are due to the attacks of the same fungus, and represent different forms of one disease. Blast is a term used to refer to the form of the disease which attacks the fruits immediately after the blossoms fall. Scald has frequently been confused with the effect of flooding followed by hot sun. This disease first appears as small light-colored softened spots on the surface of the fruit. Cranberry rot has frequently been mistaken for scald. It is due, however, to another species of fungus which causes irregular black spots just beneath the skin of the diseased fruit. Anthracnose, while due to a distinct species of fungus, can usually not be distinguished from scald except by making cultures of the fungi. All of these diseases affect the fruit and leaves.

Remedies for these diseases must be of a preventive nature, and should consist in the regulation of the water supply, destruction of diseased vines, the use of resistant varieties, and spraying with standard fungicides, preferably Bordeaux mixture made according to the 6:4:50 formula, to which a resin-fishoil soap is added to make it adhere better. During the season 5 applications should be made at intervals of not more than 15 days, using about 4 barrels of the fungicide per acre. The cost of this treatment is about $15 per acre.

Preventive treatment of grape anthracnose, L. Degrully (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 5, pp. 132, 133, pl. 1*).—Attention is called to the efficiency of dilute sulphuric acid as a wash for grapevines for the prevention of anthracnose, and the author recommends the application of sulphuric acid in a dilution of about 6 liters of acid to 100 liters of water. This should be applied to the vines as late as possible in the winter, preferably 2 or 3 weeks preceding the swelling of the buds. This treatment is to be preferred over the use of sulphate of iron or other fungicides which have been recommended.

Diseases of cocoanuts (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 3, pp. 51, 52*).—A report is given of the successful use of Bordeaux mixture for protecting cocoanut trees against the bud disease which causes the death of the trees. The experiments are still in progress and will be continued, applications being made at intervals of 6 to 9 months until there is no trace of the disease.

An injurious disease of larch, C. A. J. A. Oudemans (*K. Akad. Wetensch. Amsterdam, Proc. Sect. Sci., 6 (1904), pt. 2, pp. 498–501, pl. 1*).—A description is given of a fungus disease of the common European larch, which is characterized by the discolored appearance of the leaves and twigs of the trees.

The discoloration of the leaves proceeds from the outer portion of the rosette toward the interior, so that for a considerable period needles of two colors will be found together. The fungus appears to be restricted to the leaves, and on this account the author recommends that all fallen leaves should be collected and burned to prevent the spread of the disease.

A study was made of the organism, and it is described as *Exosporina laricis*. The affinities of this new genus are discussed.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The economic value of our native birds, H. A. Surface (*Pa. Dept. Agr., Zool. Quart. Bul., 2 (1905), No. 4, pp. 67–102, pls. 4, figs. 4*).—The author discusses the feeding habits and economic relations of woodpeckers, including hairy woodpecker, downy woodpecker, *Sphyrapicus varius*, pileated woodpecker, red-headed woodpecker, and flicker.

Slugs and snails (*Bd. Agr. and Fisheries [London], Leaflet 132, pp. 6, figs. 2*).—The habits of *Limax agrestis* and *Helix aspersa* are briefly described. Thrushes and poultry

are considered the most effective enemies of these pests. Cultivated plants may usually be protected against the attacks of slugs and snails by dressings of soot and lime, salt and lime, caustic soda and lime, or powdered coke. Caustic soda should be used at the rate of 4 parts to 96 parts of lime. All materials used to destroy slugs should be in a finely pulverized form.

Reports of the deputy commissioner of horticulture, A. CRAW and E. M. EHRHORN (*Bien. Rpt. Comr. Hort. Cal., 1903-4, pp. 34-39*).—*Scutellista cyanea* is reported as continuing its successful work as a parasite of the black scale. The latter pest is completely controlled by the parasite in many localities. Notes are also given on *Saissetia oleæ*, a South African parasite of the black scale, and on the damage due to *Diaspis pentagona.*

Condition of orchards and nursery stock in Utah and Oregon, J. ISAAC (*Bien. Rpt. Comr. Hort. Cal., 1903-4, pp. 29-33*).—A brief account is given of the conditions which were found to prevail in orchards and nursery stock in Utah and Oregon, with especial reference to injurious insects which might be imported into California. Attention was called to the existence of eastern peach-root borer in both Utah and Oregon, and the necessity of quarantining against it.

Bug v. bug, J. ISAAC (*Bien. Rpt. Comr. Hort. Cal., 1903-4, pp. 79-107, pls. 4, figs. 18*).—In this article the author presents a general account of the value of predaceous and parasitic insects in the control of insect pests.

A list is given of the beneficial insects which were exhibited by the California commissioner of horticulture at the St. Louis Exposition. The illustrations of the value of parasitic and predaceous insects are largely drawn from the extensive experience which the fruit growers of California have had with this method of fighting insect pests. It is stated that in California the chief reliance is placed on the use of efficient artificial insecticides, but that in addition to the application of washes, dips, and fumigating methods every effort has been made to secure parasitic and predaceous insects to assist in the control of insect pests. Detailed notes are given on a large number of such beneficial insects and upon the effectiveness of their parasitism.

The cotton worm, G. P. FOADEN (*Jour. Khediv. Agr. Soc. and School, 6 (1904), No. 6, pp. 12*).—Detailed notes are given on the habits and life history of *Prodenia littoralis.* The eggs are laid on only one or two leaves of each cotton plant. Heavy irrigation while the caterpillars are in the soil is beneficial.

According to the author the main reliance is to be placed in picking and destroying leaves on which eggs have been deposited. The incubation period for the eggs is 3 or 4 days, and the infested leaves should be picked during this period. Chemical insecticides are believed to be of little avail against this pest.

The cotton bollworm in Georgia. Insects injurious to corn and truck crops, R. I. SMITH (*Ga. Bd. Ent. Bul. 16, pp. 25-53, figs. 15*).—For controlling the bollworm the author recommends planting corn as a trap crop in rows 200 to 300 ft. apart throughout the cotton field, and from May 15 to June 1. Poison should be applied as soon as the worms appear on the cotton. For this purpose Paris green is effective and should be dusted on the plants. The Paris green should be mixed with dust in the proportion of 1:4 and should be applied so as to use 2 lbs. Paris green per acre.

Biological and economic notes are also given on cotton caterpillar, *Diatræa saccharalis*, corn-root worm, squash-vine borer, squash bug, cucumber beetle, potato beetle, flea beetles, cabbage worms, and plant lice.

Beet worms and their remedies, C. P. GILLETTE and S. A. JOHNSON (*Colorado Sta. Bul. 98, pp. 22, pls. 2, figs. 2*).—The beet web worm (*Loxostege sticticalis*) causes more or less injury to sugar-beet fields in the State every year.

The insect feeds upon beets, cabbages, onions, pigweed, Russian thistle, alfalfa, and perhaps other plants. Eggs are laid in clusters or sometimes singly and the insect winters over in the larval or pupal condition. This pest may be controlled by deep

plowing in the fall or early spring or by spraying with an arsenical insecticide such as arsenate of lead, arsenite of lime, Paris green, or London purple.

Beet army worm (*Caradrina exigua*) resembles beet web worm quite closely. The injuries caused by this pest are also quite similar to those of the web worm. Apparently the insect may winter over in the adult condition, but as the larvæ are in the ground immediately after the removal of the beets they may be destroyed by surface elevation. During the growing season they may be killed with arsenical sprays. Notes are also given on cutworms, with a brief account of their habits, life history, parasites, and artificial remedies.

The destruction of locusts, C. W. MALLY (*Agr. Jour. Cape Good Hope, 26 (1905), No. 3, pp. 406–420, figs. 2*).—Attention is called briefly to the natural enemies of locusts, particularly of *Pachytylus sulcicollis*.

The artificial means of destroying these locusts consists in the collection of eggs, the destruction of the young nymphs, the use of poisoned bait containing arsenic, soda, and sugar, the use of contact insecticides such as soaps and other washes, and various kinds of traps, some of which are described in detail in connection with illustrations. When hopperdozers and other kinds of locust traps are used, large quantities of the insects are usually captured. It should be remembered that the food value of locusts is considerable, and they should, therefore, not be destroyed.

Poultry raisers and ostrich farmers are glad to pay a reasonable price for such material, and locusts are also readily eaten by horses, sheep, and pigs. No single method is sufficient to control entirely the locust plague. The newly hatched locusts may be destroyed by spraying or by the use of poisoned baits, and the cultivated fields may be protected by the use of locust fences.

The biology of the brown-tail moth and an account of its ravages, A. Y. GREVILLIUS (*Bot. Centbl., Beihefte, 18 (1905), No. 2, 2. Abt., pp. 221–322, figs. 8*).—This paper constitutes an elaborate and detailed monograph of the brown-tail moth.

An account is presented of the development of the insect, its appearance in the various stages, its food plants, and the injuries caused by the pest to various cultivated plants. A long series of feeding experiments was carried out for the purpose of determining so far as possible the preferred food plants of this insect. A large variety of plants was used in these experiments and the results are presented in a tabular form. It appears that the number of caterpillars present in any locality is one factor in determining the choice of food plants.

Analyses were made of a large number of leaves to determine their content of tannin. It appears that tannin is another important factor in the problem of food plants of the brown-tail moth. This insect does not voluntarily eat leaves which do not contain tannin. This was noted particularly in the case of *Stellaria media*. When the leaves of this plant, however, were sprinkled with tannin they were eaten by the caterpillars.

Light and heat as well as moisture of the air exercise considerable influence upon the brown-tail moth. As a rule, larvæ preferred to eat in bright light. The caterpillars ate quite actively at a temperature of 40° C., but ceased eating in some cases and were killed by a temperature of 45° C. In an atmosphere saturated with moisture they appeared to lose appetite to a considerable extent.

Experiments undertaken to show the effect of cold upon the brown-tail moth indicate that when exposed the caterpillars endure temperatures as low as −16° C. without serious loss; about 40 per cent of the caterpillars resist a temperature of −21° C. for a period of 2½ hours. Caterpillars in winter nests were able to withstand a temperature of −23 to −31° C. for 24 hours, but were destroyed when the temperature reached −35.5° C. The winter nests appeared to protect the caterpillars on account of their nonconductivity. A bibliography of the subject is appended to the article.

Some notes on the habits and life history of Bembecia marginata in western Washington, W. H. LAWRENCE (*Ent. News, 16 (1905), No. 4, pp. 117-119*).—The raspberry root borer has appeared in some parts of western Washington.

The life history of this insect was studied by the aid of breeding experiments in the laboratory and field observations. The insect hibernates in the larval condition just underneath the epidermis of the canes beneath the surface of the ground. Apparently they do not burrow into the canes and down into the roots. Usually infested canes are not killed outright but merely show a poor growth.

The injuries caused by Lytta vesicatoria to the flowers of the olive, D. MARIANI (*Staz. Sper. Agr. Ital., 37 (1904), No. 6, pp. 484-489, figs. 2*).—This beetle frequently feeds upon the flowers of the olive and *Syringa vulgaris*, doing great damage. In some instances the entire inflorescence is destroyed. Brief notes are given on methods of destroying these pests.

The orange maggot, A. L. HERRERA (*Bol. Com. Par. Agr., 2 (1905), No. 7, pp. 307-448, figs. 2*).—*Trypeta ludens* was found in some Mexican oranges imported into California and State quarantine was proclaimed against the importation of all Mexican oranges. This led to a general investigation of the subject by the Mexican government, and the results of this study are published in the present bulletin.

The distribution of the insect is discussed in great detail and notes are given on the importance of the orange industry in Mexico. The author discusses also the habits and life history of a number of insects related to the orange maggot. A large part of the bulletin is of a highly controversial nature. As the result of the investigation it is concluded that the orange maggot does not exist in all parts of Mexico, and that some provinces free from the pest produce large quantities of oranges suitable for exportation. It is argued that efficient means exist for the control of this pest and that they are being applied on the Morelos estate from which the infested oranges were imported into California.

The author maintains that the orange maggot has frequently been introduced into the United States, and has never been able to establish itself either in this country or in the northern part of Mexico.

The Morelos orange maggot, E. COOPER (*Bien. Rpt. Comr. Hort. Cal., 1903-4, pp. 43-50*).—*Trypeta ludens* was found in several shipments of Mexican oranges which arrived at San Francisco. On account of the dangerous character of this insect a strict quarantine has been established against Mexican oranges, and the railroads are assisting in preventing the introduction of the pest.

A new enemy of oranges, P. MARCHAL (*Bul. Mens. Off. Renseig. Agr. [Paris], 4 (1905), No. 2, pp. 143-148*).—*Chrysomphalus dictyospermi minor* is described with particular reference to its injuries to citrus fruits.

The difficulty of combating this pest is partly due to the great variety of plants upon which it feeds, the existence of several generations per year, the differences in the ages of caterpillars of each brood, and the existence of a protective covering by means of which caterpillars resist insecticides. They may be destroyed, however, by the use of kerosene emulsion, soap insecticides, and fumigation with hydrocyanic-acid gas.

The pineapple gall of the spruce: A note on the early stages of its development, E. R. BURDON (*Proc. Cambridge Phil. Soc., 13 (1904), No. 1, pp. 12-19*).—The galls produced by different species of Chermes all follow the same general plan of development, but in the present paper particular attention is given to the galls of *C. abietis*.

The life of the gall produced by this insect on spruce may be divided into 3 stages, the first of which is inclosed in the bud scales, the second beginning after the emersion from the bud and ending with the opening of the chambers, and the third including its death and decomposition. The life history of the gall insect is described in detail with special reference to its agency in the production of the galls.

North American Phylloxerinæ affecting Hicoria and other trees, T. PERGANDE (*Proc. Davenport Acad. Sci., 9 (1901–1903), pp. 185–273, pls. 21*).—The task of monographing this group of plant lice in America was begun many years ago with the intention of publishing the material in connection with a larger monograph edited by Dr. Dreyfus of Wiesbaden, Germany. The publication of the large monograph has been so delayed that a decision was reached to publish the present material separately.

A synoptical table is given for the identification of the species according to the character of the galls produced. All species of phylloxera known to occur in North America are described and notes are given on their habits, life history, and food plants.

A treatise on spraying, J. M. STEDMAN (*St. Joseph, Mo.: The Fruit Grower Co., 1905, pp. 123, figs. 35*).—This pamphlet is intended to furnish information regarding the more important insecticides in common use, together with notes on methods of making and applying them and a brief discussion of the common injurious insects which attack apple, peach, and strawberry. The remedies recommended and methods of treatment suggested, however, are capable of wider application than to the 3 mentioned plants.

Spraying tall trees, J. A. PETTIGREW (*Country Life Amer., 7 (1905), No. 4, pp. 375, 376, figs. 3*).—Attention is called to the injury done by San José scale and other insects to tall shade and ornamental trees, and various power sprayers especially suitable for treating such trees are described.

Composition of the lime, sulphur, and salt wash, J. K. HAYWOOD (*Jour. Amer. Chem. Soc., 27 (1905), No. 3, pp. 244–255*).—A study was made of this wash, adopting different periods of boiling and using chemically pure reagents for the tests.

Careful analyses were made for the purpose of determining the reactions which take place during the manufacture of the wash. It was found that the solid sulphur was not completely dissolved during a boiling period of 15 to 30 minutes, but only after boiling from 45 to 60 minutes. When the boiling was continued beyond the hour the mixture became thick, and apparently some of the sulphur was lost mechanically. Omitting the salt "had no material effect on the composition of the wash."

In the study of the compounds of sulphur formed in the wash under different conditions, the free sulphur and that as sulphids, as sulphates and sulphites, and as thiosulphates were determined. Concerning the reaction which takes place, the following conclusions are reached: "First, the lime and sulphur react and calcium thiosulphate and pentasulphid are formed; second, the calcium pentasulphid is partly changed to calcium thiosulphate and free sulphur; third, the sulphur set free recombines to a large extent with the calcium hydroxid; fourth, the calcium thiosulphate formed is changed to a slight extent to calcium sulphite and sulphur; fifth, the calcium sulphite is partly oxidized to calcium sulphate. All of the above reactions are well known and can be found in the leading books of reference."

The changes which take place in the sulphur compounds when the wash is sprayed upon the tree were studied by applying the wash to filter paper and exposing it to the air. Later, after several days or weeks, the dried wash was analyzed, and the results are presented, showing the amounts of sulphur in different forms. There was found to be a decomposition of the thiosulphate after a time, resulting in an increase of free sulphur, sulphates, and sulphites, and it is assumed that after 4 or 5 months only sulphur and calcium sulphate would remain. This finely divided sulphur and the sulphite which is gradually set free, the author believes to be the two active agents in killing insects. "This theory of the action of the wash would also explain why the action is not immediate and also why it continues over a great length of time."

In a wet climate a rain a day or two after the spraying would tend to wash out the thiosulphate, and no sulphite could be formed. The insecticidal properties would then depend upon the sulphur left upon the tree. "It is possible that the thiosulphate itself has some value as an insecticide. If so, it would be manifested much more strongly in a dry climate than in a wet climate, where the thiosulphate would be gradually or at once washed off."

An inquiry into the cyanid method of fumigating nursery stock, W. NEWELL (*Ga. Bd. Ent. Bul. 15, pp. 24, figs. 3*).—Nurserymen in Georgia have been for several years required to fumigate nursery stock with hydrocyanic-acid gas.

On account of the different results obtained from the application of this method under different conditions, the author undertook an investigation of the cause of this apparent variation in the strength of potassium cyanid. For this purpose analyses and tests were made of samples of potassium cyanid sold by various dealers. It was found as a result of this investigation that failure to secure satisfactory results in fumigation is frequently due to the use of adulterated potassium cyanid. The amount of gas generated when the cyanid is added to the mixture of acid and water is somewhat greater than when the latter mixture is poured over the cyanid.

It was found that the presence of common salt in the cyanid causes a reduction in the amount of gas available for destroying insects. Common salt is most frequently used in the adulteration of potassium cyanid. The effectiveness of a sample of cyanid is not indicated by an analysis which shows it to be high grade according to the amount of potassium cyanid present unless the analysis also shows the absence of chlorids, nitrates, and other adulterants.

In the study of the effect of temperature upon the formation of hydrocyanic-acid gas it was found that the temperature produced by the mixture of 2 fluid ounces of sulphuric acid and 4 fluid ounces of water is apparently the optimum temperature for the volatilization of the gas.

Notes on a light trap in Hertfordshire, P. J. BARRAUD (*Ent. Mo. Mag., 2. ser., 16 (1905), No. 182, pp. 43, 44*).—The author has made use of a lantern trap for catching lepidoptera since 1898. During this period over 300 species of lepidoptera have been captured. The trap is attached to a first-floor window about 14 ft. from the ground. The author believes that the want of success with traps in many cases is due to the fact that they are placed too near the ground. It is believed that an elevation of 20 ft. is desirable for a great many species of lepidoptera.

Report of the New Jersey State Agricultural Experiment Station upon the mosquitoes occurring within the State, J. B. SMITH (*New Jersey State Sta., 1904, pp. V+482, pls. 47, figs. 89*).—In this report the author summarizes the results of some investigations regarding the anatomical characters, habits, distribution, natural enemies, and means of combating the mosquitoes which occur in New Jersey.

Special chapters are devoted to the hibernation of mosquitoes, the agency of these insects in carrying diseases, a description of species of mosquitoes occurring in New Jersey, the classification of mosquitoes with a key as an aid to their determination, and various local problems in the eradication of the mosquito nuisances in different parts of the State. The author has collected a large fund of information which will be of value in the further study of the mosquito problem. This is particularly true of the sections on breeding places, natural enemies of the mosquitoes, and artificial insecticide measures.

Among the various insecticides which were used in the destruction of mosquitoes none proved more efficient against the larvæ than kerosene oil. Phinotas oil is useful in sewer catch-basins, cesspools, and other pools of water in which there are no fish. This oil, however, is not soluble in salt or brackish water and can not, therefore, be used in salt marshes. Carbolic acid and cresol preparations were found to be effective when used in their proper strengths, but were found too expensive. Permanganate of potash was carefully tested and found to be practically without any

destructive effect upon the mosquitoes. Chloronaphtholeum is found to be valuable as a general disinfectant, but is of little use in salt water. In experiments with copper sulphate the larvæ were killed in a certain percentage of cases, but quite gradually and apparently by an indirect rather than a direct action. The larvæ of *Culex pipiens* succumbed within 72 hours in water containing copper sulphate at the rate of 1 to 53,500. In some cases, however, the larvæ survived for 24 hours when the copper sulphate was used at the rate of 1 to 308 parts of water. The pupæ were not much affected by copper sulphate. The activity of copper sulphate was somewhat greater in salt water. A test of lime showed that this substance must be used in large quantities in order to be effective. Chlorid of lime was more effective, and when used at the rate of 14 grains in 1 qt. of water kills the larvæ but not the pupæ.

The use of sulphate of copper alone, and in combination with lime, for the destruction of mosquito larvæ, as a deodorant, and as a disinfectant, A. H. DOTY (*Med. Rec. [N. Y.], 67 (1905), No. 3, pp. 90–92*).—A test was made of the value of solutions of copper sulphate and lime alone or in combination in the destruction of mosquito larvæ in water.

The copper sulphate was used at the rate of 12 grains for each gallon of water, and lime was added in equal quantity. In these experiments it was found that the combination of copper sulphate and lime was considerably more effective than either substance used alone, although lime was quite effective alone. The action of these substances in the control of mosquito larvæ appears to be due to the destruction of the food substances upon which the larvæ live.

The effect of Aspergillus niger and A. glaucus on the larvæ of Culex and Anopheles, B. GALLI-VALERIO and JEANNE ROCHAZ-DE JONGH (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 2, pp. 174–177, figs. 2*).—A number of bacterial and fungus organisms were studied for determining their effect upon mosquito larvæ in water.

It was found that the spores of *Aspergillus niger* and *A. glaucus* were capable of infecting mosquito larvæ and causing evident disease within from 24 to 48 hours. After infection with *A. niger* the intestines of mosquito larvæ were protruded in the form of a long tubular organ of a greenish or black color and filled with the spores and mycelium of the fungus. These experiments were made in glass vessels in the laboratory.

Similar experiments out of doors in pools containing stagnant water were less successful. A much smaller percentage of the larvæ became infected. Fish were not attacked by the fungi, and the authors believe that this method may be depended upon to assist in controlling mosquitoes.

Microscopic mites, C. FULLER (*Natal Agr. Jour. and Min. Rec., 7 (1904), No. 9, pp. 849–866, figs. 10*).—A brief general account is given of the anatomy and biology of mites injurious to animals. Special attention is devoted to *Sarcoptes scabiei* of man, and the varieties of this species which attack domestic animals causing scabies or scab. Biological and economic notes are also presented on various other species of mites parasitic on cattle, goats, dogs, cats, and poultry.

Cattle ticks and blood-sucking flies of the Dutch East Indies, J. C. KONINGSBERGER (*Veeartsenijk. Bl. Nederland Indië, 15 (1903), No. 2, pp. 141–147, pl. 1*).—A brief account is presented of *Rhipicephalus annulatus*, *R. decoloratus*, *R. australis*, *Amblyomma testudinarium*, and a number of blood-sucking flies including species of Tabanus and Stomoxys.

The biology of ticks, P. MÉGNIN (*Jour. Anat. et Physiol. [Paris], 40 (1904), No. 6, pp. 569–589, figs. 4*).—According to the present system of classification, 294 species are recognized as belonging to the family Ixodidæ. Of this number, 20 have been found on dogs. Nearly all species of ticks, however, may be found on a considerable variety of animals, since no strict choice in this matter is exercised by the ticks.

The author argues, at considerable length, that the agency of ticks in transmitting Texas fever has not been proved, and considers that in order to demonstrate this point it is necessary to find the pathogenic organism of Texas fever in the adult ticks, the eggs, larvæ, and nymphs.

Notes on Ixodidæ, L. G. NEUMANN (*Arch. Par., 9 (1905), No. 2, pp. 225-241*).—Detailed, descriptive notes are presented on a number of species of ticks, some of which are described as new.

Experiments regarding the attraction of flowers for bees, JOSEPHINE WERY (*Acad. Roy. Belg., Bul. Cl. Sci., 1904, No. 12, pp. 1211-1261*).—A historical statement is presented showing the views which have prevailed at different times regarding causes which determine the relative preference of certain flowers by bees.

An elaborate series of experiments was carried out by the author, during which care was exercised to study only one of the possible sources of attraction in flowers at each test. As a result of this investigation it is concluded that flowers possessed of bright colors have much greater attraction for bees than dull colored flowers. Nectar apparently does not attract the bees. It was found possible to attract bees quite successfully by means of artificial flowers.

Bees do not respond very readily to the perfume. Form, color, and perfume operating together, however, exercise a strong attraction for bees. It is believed that, as a rule, the attraction exercised by the form and colors of flowers is approximately 4 times as strong as that exercised by perfume, pollen, and nectar taken together.

A practical manual of sericulture, H. L. A. BLANCHON (*Manuel Pratique du Sériculteur. Paris: Charles Amat, 1905, pp. 144*).—In this volume the author covers in a concise manner the whole field of silk raising, including an account of the anatomy and physiology of the silkworms, silkworm nurseries and their disinfection, care of silkworm eggs, methods of incubation, the care of silkworm larvæ in their various stages, cocoons, the feeding of the larvæ, etc.

Notes are also given on the amount of space which should be allowed for the successful practice of silkworm raising, the ventilation of buildings, temperature to be maintained, humidity of the air, and related subjects. Special chapters are also presented on the various diseases of silkworms and on the cultivation of mulberry trees.

Attempts to increase the amount of silk in cocoons, F. LAFONT (*Ann. École Nat. Agr. Montpellier, n. ser., 4 (1905), No. 4, pp. 253-274*).—In a series of breeding experiments moths were reared from large and from small cocoons, and their progeny were compared for the purpose of determining whether the size of the cocoons could be thus increased. This method of selection gave little or no promise of success. Within a few generations the size of the cocoons was about equal in all cases. The author believes that better results are to be obtained by selecting cocoons on the basis of vigor rather than of size.

Spider-spun silk, W. H. HUNT (*Mo. Consular Rpts. [U. S.], 1905, No. 293, pp. 157-159*).—Considerable attention has been given in Madagascar to the use of the web spun by spiders in the manufacture of silk. The most promising species of spider for this purpose is *Nephila madagascariensis*. This is a large spider which spins an extensive web of more than usual strength. Several fabrics have already been made of this material, and it is believed that the spider silk is a promising material for commercial utilization. The habits of the spider are such that it may possibly be colonized and maintained under a state of semidomestication.

FOODS—HUMAN NUTRITION.

Potatoes: A cooking test (*Mark Lane Express, 91 (1904), No. 3822, p. 769; 92 (1905), No. 3833, p. 334*).—At Marks Tey, Essex, a test was made of the cooking quality of potatoes from Scotland, Lincolnshire, and Essex, 6 tubers weighing as nearly as possible 6 oz. each being selected from 12 standard varieties.

The potatoes were placed in cold water, then boiled slowly and steamed for a few moments before serving, each sample being cooked in a separate pot. Judged by flavor, texture, and appearance the Essex potatoes were markedly superior to the others, the highest score being made with Essex-grown Charles Fiddler and Sim Gray. The Scotch samples scored the fewest points. The need of a test in the spring also was pointed out by the judges.

After 12 weeks an additional test was made to learn the effects of storage on cooking quality. Factor and Warrior were the varieties which had the highest total score on the basis of flavor, texture, and appearance when freshly cooked. After standing for 24 hours the cooked potatoes were again examined, the above mentioned varieties and several others being unchanged, though the majority had deteriorated.

Does an egg change in weight in cooking? L. CAMUS (*Compt. Rend. Soc. Biol. [Paris], 57 (1904), No. 25, pp. 87-90*).—A number of tests are reported which showed that eggs cooked in hot water lost more or less in weight, the amount in all cases being small. This loss the author attributes to the evaporation of a little water through the porous shell. If the egg was cooled in the water in which it was cooked it increased a little in weight.

The "yolk cure" in the treatment of the underfed, H. STERN (*Med. Rec. [N. Y.], 66 (1904), No. 27, pp. 1049-1052*).—In a discussion of the use and importance of egg yolks in invalid dietetics, the author has reported some data on the digestibility of eggs obtained in experiments with healthy subjects.

It was found that raw or half-raw yolk was very readily digested, 2 to 4 raw-egg yolks leaving the stomach in from 70 to 100 minutes. One or 2 egg yolks taken in a cup of hot coffee with some sugar and milk left the stomach in 60 to 70 minutes. In the author's opinion the fat of egg yolks is especially well borne and readily assimilated, as is shown by the recovery of only 1.5 to 3.5 per cent of the yolk fat in the feces as compared with larger amounts in the case of milk fat and other animal fats.

In the author's opinion, the high digestibility of egg-yolk fat is probably due to the fact that it has a low melting point and is fluid at ordinary temperatures. The importance of the lecithin present is spoken of.

The examination and valuation of raspberry juice, P. BUTTENBERG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 3, pp. 141-145*).—The results of examinations of raspberry juice and sirup prepared in different ways are reported and discussed.

Concerning the examination and valuation of candied coffee, E. ORTH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 3, pp. 137-141*).—The results of a number of tests are reported on the amount of soluble material on the coffee beans, and the total amount of coffee produced when the coffee berry was treated with different amounts of sugar and heated for varying periods. The author states that other material awaits publication.

Note on a vegetable cheese from Kamerun, W. BUSSE (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 15-16, p. 480*).—Brief notes are given on a cheese-like material prepared from the seeds of *Treculia africana*.

Studies of arsenic in a number of food products, F. BORDAS (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 4, pp. 333-336*).—A summary of data regarding the occurrence of arsenic in food products, including the author's investigations.

Expenses for food in laborers' budgets, E. LEVASSEUR (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 4, pp. 289-296*).—A summary of data regarding the proportion of the income of laborers which is expended for food.

Legislation relating to commerce in food products (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), Nos. 4, pp. 347-388; 5, pp. 538-553; 6, pp. 651-664*).—A summary of legislation enacted in Europe and America.

The value of nutrients (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 5, pp. 453-457*).—Replies received from a number of investigators are summarized having to do

with the question of the isodynamic replacing value of fats and carbohydrates in a ration.

Criticism of the methods followed in establishing dietary standards, L. PASCAULT (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 3, pp. 200-207*).—In the author's opinion, most of the studies used to determine dietary standards have been made with overnourished subjects, this being a common condition. He points out that investigations are needed which are not open to this criticism. He believes that it will probably be found that the physiological ration will vary considerably with the character of the diet.

On the absorption and utilization of proteids without intervention of the alimentary digestive processes, L. B. MENDEL and E. W. ROCKWOOD (*Amer. Jour. Physiol., 12 (1904), No. 4, pp. 336-352*).—In experiments with animals the absorption of proteids introduced directly into the small intestine, into the peritoneal cavity, and into the circulation was studied. The authors' summary of the investigation follows:

"Vegetable proteids (crystallized edestin from hemp seed and excelsin from the Brazil nut), slowly introduced in solution into the circulation of animals, can apparently be retained in the organism for the most part, even when the quantities introduced almost equal that of the globulins normally present in the blood. . . . When solutions of vegetable proteids are injected too rapidly or in too great concentration, toxic symptoms, including an inhibition of the cardiac and respiratory activities, may be observed, especially in cats. . . .

"The chemically similar proteids, edestin and excelsin, show slight differences in physiological action, a small amount of a proteose-like substance being found in the urine after intravenous or intraperitoneal (parenteral) introduction of excelsin, but not with edestin. The observation suggests the further possibility of applying chemicobiological reactions in distinguishing related proteids.

"The vegetable proteids soon disappear in considerable part when introduced into the peritoneal cavity. That they reach the circulation is made probable in the case of excelsin at least, by the appearance of the typical urine proteose-body noted after direct intravenous injections. For the most part, however, the proteids do not reappear in the urine.

"The unaltered proteids edestin and casein are absorbed to a very small extent, if at all, from portions of the living small intestine in which the ordinary digestive processes are excluded as far as possible. On the other hand, the proteoses and peptones obtained by peptic digestion of these proteids readily disappear from the intestine under the same conditions. It is not necessary to assume that in these cases they are first completely broken down by the intestinal enzym erepsin; for casein (upon which erepsin can act) may remain unabsorbed. Dissolved edestin could be recovered in crystallin form, i. e., unchanged after remaining in the intestine for several hours. The typical vegetable proteids show no marked differences from those of animal origin in their relation to the processes of metabolism.

"The attempts to learn the fate of the foreign proteids retained in the system have been rather unsuccessful. It will be of interest to ascertain something further regarding their destination and the exact mode of utilization which they undergo."

The passage of different food stuffs from the stomach and through the small intestine, W. B. CANNON (*Amer. Jour. Physiol., 12 (1904), No. 4, pp. 387-418, figs. 9*).—Different amounts of protein, fat, and carbohydrate foods were mixed with a small amount of subnitrate of bismuth and fed to cats. The processes of digestion were studied at regular intervals for 7 hours after feeding by means of a fluorescent screen and the Röntgen rays.

The investigations are summarized as follows:

"Fats remain long in the stomach. The discharge of fats begins slowly and continues at nearly the same rate at which the fat leaves the small intestine by absorption

and by passage into the large intestine. Consequently there is never any great accumulation of fat in the small intestine.

"Carbohydrate foods begin to leave the stomach soon after their ingestion. They pass out rapidly, and at the end of 2 hours reach a maximum amount in the small intestine almost twice the maximum for proteids, and two and a half times the maximum for fats, both of which maxima are reached only at the end of 4 hours. The carbohydrates remain in the stomach only about half as long as the proteids.

"Proteids frequently do not leave the stomach at all during the first half hour. After 2 hours they accumulate in the small intestine to a degree only slightly greater than that reached by carbohydrates an hour and a half earlier. The departure of proteids from the stomach is therefore slower at first than that of either fats or carbohydrates. An exception to this general statement was found in egg albumen, which, both in its natural state and in coagulated form, was discharged from the stomach at about the carbohydrate speed.

"When carbohydrates are fed first and proteids second, the presence of proteids in the cardiac end of the stomach does not materially check the departure of the carbohydrate food lying at the pylorus; but the presence of proteids near the pylorus, when proteids are fed first and carbohydrates second, markedly retards the onward passage of the carbohydrates which under these circumstances predominate in the cardiac end of the stomach.

"When carbohydrates and proteids are mixed in equal parts, the mixed food does not leave the stomach so slowly as the proteids, nor so rapidly as the carbohydrates—the discharge is intermediate in rapidity.

"In a mixture of fats and proteids in equal parts, the presence of the fat causes the proteid to leave the stomach even more slowly than the proteid by itself. Fat mixed with carbohydrate in equal amounts also causes the carbohydrates to pass the pylorus at a rate slower than their normal.

"Doubling the amount of carbohydrate food (50 cc. instead of 25 cc.) increases the rapidity of the carbohydrate outgo from the stomach during the first 2 hours; whereas doubling the amount of proteid food strikingly delays the initial discharge of proteid from the stomach.

"The process of rhythmic segmentation is seen with all three kinds of food stuffs, and the frequency of its occurrence corresponds roughly to the amount of food present in the intestine; a measurement of the length of the segmenting masses in a given number of cases shows that at the regular times of observation, during the first 7 hours after feeding, the amount of segmenting activity in the presence of carbohydrates was much greater than in the presence of either fats or proteids. Egg albumen is excepted in this general statement

"The interval between the feeding and the appearance of food in the large intestine is variable, but the mean for carbohydrates is about 4 hours, for proteids about 6 hours, and for fats about 5 hours. After time is allowed for the later start of proteids from the stomach, there still remains a probability that the proteids pass through the small intestine more slowly than do the carbohydrates."

Changes in the excretion of carbon dioxid resulting from bicycling, G. O. HIGLEY and W. P. BOWEN (*Amer. Jour. Physiol., 12 (1904), No. 4, pp. 311–335, figs. 7*).—A respiratory mask of special construction is described which fits tightly over the nose and mouth and contains valves for the separation of the inspired and respired air current.

The respired air is dried by passing through tubes filled with pumice stone and sulphuric acid and then through a gas meter, which is connected with the suction side of a blower, in order to relieve the lungs of the subject from the labor involved in forcing the expired air through the tubes and gas meter. The dry air containing carbon dioxid passes through an absorption apparatus attached to one arm of a counterpoised balance. As the arm sinks, owing to the absorption of carbon dioxid,

a pointer attached to the other arm traces a curve on a drum covered with blackened paper. After the apparatus was calibrated it was tested and found to be very accurate.

About 20 experiments were made to determine the general course of the changes in the output of carbon dioxid resulting from work, which was performed on a stationary bicycle. The working periods in some of the experiments covered 30 to 45 minutes. A large number of experiments were also made to show how soon the effect of muscular work is noted in the carbon dioxid output. The general conclusions which were drawn from the experiments follow:

"The problem of finding the changes in rate of output of carbon dioxid resulting from muscular work and other causes is practically solved by the method used in this research. The latent period of increase in output of carbon dioxid from the lungs in case of beginning work is in the close vicinity of 20 seconds, and the increase reaches its maximum in about 2 minutes. The output of carbon dioxid from the lungs is practically uniform from minute to minute during uniform muscular work, after the blood has had time to take part fully in the process of elimination. Upon cessation of work the output of carbon dioxid decreases to the normal amount in about the time occupied by its increase and after a like latent period. The results obtained show no indication of any connection of cause and effect between the production and elimination of carbon dioxid and the secondary rise of pulse rate."

The minimum amount of protein in the daily diet, H. LABBÉ (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 4, pp. 311-328, dgm. 1*).—An experiment is reported in which the subject, a healthy man, lived upon a simple diet of bread, butter, chocolate, wine, chestnuts, vegetables, and fruits.

At the beginning of the test, which covered 38 days, the daily diet furnished a little over 14 gm. nitrogen. The amount was diminished until toward the end of the test it reached a minimum of 1.06 gm. It was then increased and on the last day reached 13.25 gm. The amount of nitrogen and urea eliminated in the urine and the income and outgo of chlorin are recorded. The energy value of the diet was also calculated at different periods. At the beginning of the test the subject weighed in round numbers 65 kg. and 3 days before the close 63 kg.

In the author's opinion the experiment showed that nitrogen equilibrium can be established and maintained for a long period on a limited protein ration derived entirely from vegetable sources. This indicates that vegetable protein is as valuable as that from animal foods. The nitrogen excreted in the urine other than in the form of urea is discussed, the author pointing out that the quantity is remarkably constant. The experiment is discussed with reference to the lowest protein limit in the diet.

Concerning the minimum amount of nitrogen required per day in a condition of rest and work, A. GAUTIER (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 4, pp. 329-331*).—A critical discussion of the experiment reported above. The author does not agree with all the conclusions reached.

An excess of chlorin in the diet for fifty-one days, L. AMBARD (*Compt. Rend. Soc. Biol. [Paris], 58 (1905), No. 8, pp. 375, 376*).—Chlorin equilibrium was studied when an excess was consumed, and also the effect of sodium sulphate and potassium nitrate on the elimination of sodium chlorid, the author being himself the subject.

When about 1.75 gm. sodium chlorid was taken the daily excretion in the urine was fairly constant during two periods, being about 2.2 gm. per day. In a third period it was 1.55 gm. When 10 gm. sodium sulphate was added to the diet the chlorin elimination diminished somewhat. Three grams potassium nitrate daily did not increase the excretion of sodium chlorid appreciably. During part of the time the sodium chlorid in the feces was found to average 0.1 gm. per day.

ANIMAL PRODUCTION.

The feeding of farm animals, O. KELLNER (*Die Ernährung der landwirtschaftlichen Nutztiere. Berlin: Paul Parey, 1905, pp. VIII+594*).—This volume, which embodies the results of the author's investigations extending over many years, is an attempt to treat the subject of the feeding of farm animals from a comparatively new standpoint.

The author contends that as feeding stuffs differ in the ease with which they are assimilated by the body, they should be compared on the basis of the quantity of nutritive material which is available after the amount required for assimilation has been taken into account, rather than on the basis of proximate composition or the percentage of digestible nutrients present. For his comparison he has selected the starch equivalents of the feeding stuffs as a basis rather than energy values which have sometimes been used.

The book as a whole marks a distinct advance in the theoretical discussion of stock feeding, and will prove of value not alone to students but also to practical feeders and to all who are interested in discussions of such subjects. The volume is composed of 3 main divisions. The first is concerned with the composition, digestibility, and utilization of feeding stuffs and the second with the properties, preservation, preparation, and use of feeding stuffs, while the third takes up the feeding of farm animals with relation to different agricultural conditions.

In an appendix the author gives a number of tables showing the composition and digestibility of feeding stuffs, in which special attention is paid to the feeding values on the basis of starch equivalents. Feeding standards are also included. These, like the other tabular matter, embody the author's views regarding the use of data showing the real feeding value rather than values based on composition and digestibility only. A detailed index adds to the value of the volume.

Feeding stuff inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 115, pp. 53–70*).—Analyses of samples collected during the fall and winter of 1904–5 are reported, including cotton-seed meal, gluten meals and feeds, linseed meal, viscid oil meal, sugar and flax seed, distillers' grains, mixed grains, hominy feed, meat meal, ground beef scraps and similar feeds, mixed and proprietary feeds, wheat bran, bran and shorts, corn meal, flour, and condimental feeds.

In general, the cotton-seed meal was of good quality, but it was noted that the number of samples containing above 43 per cent protein was less than a few years ago. "Gluten products continue to be the most unsatisfactory of any concentrated feeds on the market. This is partly because different lots of the same brand vary somewhat in composition, but is chiefly because certain companies persist in putting a guarantee upon their goods that the goods do not come up to in any instance."

As shown by composition, the viscid oil meal, an old-process linseed meal, had a fairly high feeding value, but the taste was unpleasant, "and it would seem doubtful if cattle would eat it readily." As regards adulterated mixed feeds the authors note that "there is so much profit in selling ground corn cobs, broom corn, and other valueless materials at the price of wheat bran, that the consumer must ever be on the watch against this fraud. The safest thing is to buy only well-known, reliable brands of this class of goods. If consumers will see to it that all of this class of feeds which they buy carries the name of the miller, there will be little likelihood of their being defrauded."

The condimental feeds examined were found, as was previously the case, to consist of wheat bran or some similar concentrated feed, with small amounts of fenugreek, charcoal, sulphur, salt, copperas, and similar bodies added. Attention is directed to the very high cost of these foods in proportion to their nutritive value or in proportion to the amount and value of the materials used in their manufacture for their supposed medicinal properties.

Low grade and high grade cotton-seed meal compared, J. M. BARTLETT (*Maine Sta. Bul. 115, pp. 71-76*).—Different grades of cotton-seed meal are discussed, and brief directions given for judging the quality of such goods.

A first-class meal, according to the author, should contain over 40 per cent protein and about 9 per cent fat, and should be of a light yellow color. Dark color and the presence of many fine black specks is an indication that ground hulls have been added. A rusty brown color indicates that the meal is old or has undergone fermentation. Such meals are not safe to use. Cotton-seed meal should have about the same texture as corn meal, and should be practically free from lint.

The amount of lint can be determined by sifting a portion of the meal. Lint and hulls can also be detected by stirring the meal in water, when the black hulls will settle to the bottom, the good meal will be in the next layer, and the lint on top. A first-class meal should have only a few black hulls and scarcely any lint. The quality of the cotton-seed meal can also be judged by tasting it. "The best fresh meals have a very agreeable nutty flavor not found in inferior goods. The presence of much fiber is readily noted by the sense of touch in the mouth. The absence of the nutty flavor and the presence of a rancid taste indicates that the meal is old."

The author roughly divides cotton-seed meals into 4 grades, analyses and the digestion coefficients of which are given. The results of the digestion experiments follow:

Average coefficients of digestibility of different grades of cotton-seed meal—Experiments with sheep.

Kind of meal.	Dry matter.	Organic matter.	Protein.	Fat.	Crude fiber.	Nitrogen-free extract.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Very high grade cotton-seed meal	90.0	95.3	83.3	100.0	....	95.9
Dark colored cotton-seed meal	85.8	89.9	82.2	97.2	....	94.7
Medium grade cotton-seed meal	73.0	78.0	83.6	94.6	43.5	82.1
Low grade cotton-seed meal	61.4	64.1	72.6	90.1	37.8	67.8

The author points out that although the different grades of meal did not differ much in chemical composition yet the digestion experiments showed that the low-grade meals were decidedly inferior.

Licensed concentrated feeding stuffs, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Bul. 122, pp. 16-21, 25-28*).—The percentage of protein and fat in 58 brands of concentrated commercial feeding stuffs licensed for sale in Wisconsin for the year ending December 31, 1905, is given, and the text of the Wisconsin feeding-stuff law is quoted.

The cost and value of concentrated feeding stuffs, G. FAYE (*Landmandsblade, 37 (1904), No. 29, pp. 405-408*).—The value of the various concentrated feeding stuffs used in Denmark is calculated on the basis of their average chemical composition and relative cost of nitrogenous substances, fat, and nitrogen-free extract of 1.5:2:1, as obtained by Stein (Ugeskr. Landm., 1904, p. 211).—F. W. WOLL.

The identification and adulteration of feeding cakes, G. D'IPPOLITO (*Staz. Sper. Agr. Ital., 37 (1904), No. 4-5, pp. 309-324, pls. 3*).—The data reported have to do with the detection of adulteration in feeding cakes by microscopical methods.

Poisonous Italian linseed cakes, J. HUGHES (*Mark Lane Express, 92 (1905), No. 3830, p. 235*).—Castor beans were identified in some Italian linseed cake which was found to be poisonous when fed to steers.

Peat-molasses, H. PELLET (*Sucr. Indig. et Colon., 64 (1904), No. 11, pp. 325-330*).—Experiments on the digestibility and feeding value of peat-molasses are summarized.

The value of amids in animal nutrition, W. VÖLTZ (*Fühling's Landw. Ztg., 54 (1905), Nos. 2, pp. 41-49; 3, pp. 96-100*).—Investigations which have to do with

the nutritive value of amids are summarized and the following general conclusions drawn:

In the case of herbivora and birds, asparagin acts as a protector of protein when the nutritive ratio of the ration is wide, though this is not generally the case when the ration furnishes large or medium amounts of protein. In the case of milk-producing animals, asparagin and other amids within limits can apparently replace protein without lowering the quantity or quality of the milk.

In the case of omnivora the protein-protecting power of the asparagin is smaller and as regards nitrogen metabolism it is practically an indifferent body. It can not be said that asparagin exercises a protein-protecting power in the case of carnivora. It seems rather to increase the cleavage of protein.

Grape pomace in the feeding of farm animals, H. Blin (*Jour. Agr. Prat., n. ser., 8 (1904), No. 50, pp. 766–768*).—On the basis of the work of other investigators and his own experience, the author states that 10 to 12 kg. per head per day may be fed to horses, 20 to 25 kg. to cattle, 5 or 6 kg. to sheep, and 5 to 10 kg. to pigs.

Report on feeding experiments with rough cotton cakes from Indian cotton seed, D. A. Gilchrist (*County Council Northumb., Ed. Com., Ann. Rpt., 8 (1903–4), pp. 10–26; Bul. 1, pp. 19*).—Some data are recorded regarding the amounts of cake, oil, and refuse obtained from crushing rough decorticated and delinted Indian cotton seed, and feeding trials with sheep and steers are reported in which Indian and Egyptian cotton-seed cakes were compared.

The conclusion is drawn that "Indian (Bombay) rough cotton-seed cake, when of good quality, gives satisfactory results with stock fed indoors or on pasture, and that its high manurial value makes it a desirable manurial agent, especially for improving poor pasture."

Feeding value of swedes, D. A. Gilchrist (*County Council Northumb., Ed. Com., Ann. Rpt., 8 (1903–4), pp. 27–34*).—The feeding value of Arctic, XL All, and Best of All swedes, containing respectively 11.48, 10.75, and 11.31 per cent dry matter, was studied with 3 lots of 4 calves 29 weeks old, the turnips being supplemented by hay and a mixture of Egyptian cotton-seed cake, barley meal, and linseed cake.

In the 4 months of the test the gains ranged from 208 lbs. with XL All swedes to 243 lbs. with Best of All swedes. From this and a test with sheep previously reported (E. S. R., 15, p. 897) the conclusion is drawn that in general the Swedish turnips with a high percentage of dry matter had a correspondingly high feeding value.

Digestibility of vetch hay and corn silage, J. Withycombe and A. L. Knisely (*Oregon Sta. Bul. 85, pp. 13*).—Digestion experiments were made with vetch hay (*Vicia sativa*) and with corn silage, using 3 cows. The tests were each of 7 days' duration.

The average coefficients of digestibility found for vetch hay were: Dry matter 66.05, protein 69.91, ether extract 71.21, nitrogen-free extract 71.59, crude fiber 57.56, and ash 52.23 per cent. The values for corn silage were: Dry matter 73.08, protein 55.03, ether extract 89.91, nitrogen-free extract 75.65, crude fiber 75.34, and ash 47.98 per cent.

The prickly pear and other cacti as food for stock, D. Griffiths (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 74, pp. 48, pls. 5, fig. 1*).—The geographical distribution of cacti, methods of feeding, machinery for preparing prickly pear for feeding, the effects of prickly pear upon stock, pear thickets and their destruction, the yield of prickly pear, and other questions are considered, and data collected in the cactus regions of the United States are summarized and discussed with special reference to the value of cacti as forage plants.

The so-called "prickly pear" is the variety of cactus usually referred to in considering cacti as forage plants, but according to the author, "any cactus growing

large enough to be fed with economy can be used as roughage, or as a succulent for milk production."

Prickly pear is very succulent and hence necessarily has a low nutritive value. The data summarized lead to the conclusion, however, that it may be fed to cattle with decided advantage during prolonged drought when more nutritious feed is scarce, and that it may be used to fatten cattle if fed with some coarse fodder and with some concentrated feed. Supplemented by concentrated feeds and some hay or pasturage, it is regarded as a valuable accessory to the dairy ration, supplying succulence which it is difficult to secure in semiarid regions. A ration of from 40 to 70 lbs. per day with plenty of other nutritious feed is recommended for cows, though up to 100 lbs. may be fed.

Oxen, it is stated, can be worked indefinitely on a ration consisting largely of prickly pear and require watering only 2 or 3 times a week in summer. A full-grown steer on pear alone will consume from 125 to 200 lbs. daily. The liability of forming fiber balls when fed whole and exclusively is mentioned. Hogs fatten well on the fruit of the prickly pear and take kindly to a ration of prickly pear when the thorns are properly singed off.

The methods of preparation for feeding by singeing, by slicing, and by steaming are described. Ensiling is also mentioned, but is not considered advantageous. When the pear is burned it scours cattle much worse than when scorched sufficiently to take the thorns off. Chopped pear sours quickly and hence must be fed at once. Pear cut and piled up under cover will keep in good condition for a month or more.

The uses of cacti for other purposes are pointed out, including the preparation of jellies from the fruits, the use of the joints by the Mexicans as pot herbs and for pickles, and the manufacture of a sort of candy from the pulp.

Feeding steers on sugar-beet pulp, alfalfa hay, and farm grains, W. L. Carlyle, C. J. Griffith, and A. J. Meyer (*Colorado Sta. Bul. 97, pp. 13, figs. 8*).—Using 3 lots of 50 steers each, the value of sugar-beet pulp and alfalfa, with and without grain, was studied.

In the 25 weeks of the test the average daily gain on the ration containing oats and barley was 1.9 lbs. per head, on the ration containing corn 2 lbs., and on that containing no grain 1.57 lbs. The greatest range in the cost of a pound of gain was noticed in the first and last mentioned lots, being 6.53 cts. and 3.79 cts., respectively. Data are recorded regarding the shrinkage in shipping, as well as some of the details of the slaughter test.

The authors state that no appreciable difference was noted in the quality or grade of the meat of representative carcasses selected from each lot. Judged by the results of cooking tests, the meat from the lot fed beet pulp and alfalfa hay only was as good or better than that from the other lots.

The principal conclusions drawn regarding the feeding value of sugar-beet pulp were in effect as follows:

In feeding sugar-beet pulp absolute cleanliness should be observed. It should be fed in troughs or "bunks" provided for the purpose, only such an amount being given at one time as the cattle will clean up with reasonable waste, and the bunks should be cleaned daily. Unless this be done they will gradually become filled with frozen pulp in cold weather and with decaying pulp during warm weather. Pulp should never be fed late in the afternoon during cold weather. The cattle generally refuse to eat after nightfall and whatever remains in the bunks freezes before morning.

Pulp has a laxative tendency. On this account it is well to feed good alfalfa hay of the first cutting with it, if convenient. The feed racks for hay and bunks for pulp should be near together. Cattle seem to be particularly fond of well-cured ensiled pulp, preferring this to fresh pulp. In order to secure the pulp in its best form, it is desirable to have it placed in the silo fresh from the factory and fed directly from

the silo. After fermentation has once begun exposure to the air in handling causes the pulp to deteriorate rapidly. Cattle relish it less after a continual exposure to the air, and reject a larger percentage than they would in the case of pulp direct from the silo.

Cattle-feeding experiment, W. Bruce (*Edinb. and East of Scot. Col. Agr. Bul. 4, pp. 18–35*).—The value of Bombay cotton-seed cake with damaged oats 3:1 in comparison with compound cake was studied with 2 lots of 8 steers each, the feeding test covering 6 months.

The ration was so arranged that the amount of compound cake fed was equivalent in money value to the cotton-seed cake mixture. The compound cake gave the lesser increase, the total gains made by the two lots being 1,832 and 1,631 lbs. In a second test 2 lots containing 8 cattle were fed large rations containing Bombay cotton-seed cake and other grains for 5 months. One of the lots was given fewer turnips than the other, but received some potatoes in addition. With the ration containing a smaller amount of turnips the gain was 2,387 lbs., and with the other 2,583 lbs. The effect of the different rations on the quantities of turnips consumed is taken into account in discussing the tests.

The studies show, according to the author, that supplying a moderate amount of concentrated feeding stuffs as a supplement to the home-grown products "at current prices brings the greater direct profit to the farmer, and that in intensive feeding a very considerable part of the return for the turnips must be accepted in the form of the manuriai residue derived from the feeding stuffs."

Feeding cattle with different quantities of the same concentrated foods, T. Winter (*Bd. Agr. and Fisheries [London], Ann. Rpt. Agr. Ed. and Research, 1903–4, pp. 66–68*).—A lot of 5 steers fed 10 lbs. of grain per head per day gained 2.37 lbs. each in 50 days, as compared with 2.55 lbs. gained by a lot fed 15 lbs. of concentrated feed.

With both lots the grain at first consisted of decorticated cotton-seed cake and maize meal; later linseed cake replaced the cotton-seed cake. The 2 lots consumed practically the same amounts of coarse fodder. The extra gain, according to the author, was not sufficient to compensate for the extra cost of the larger ration.

Sheep-breeding experiments, T. Winter (*Bd. Agr. and Fisheries [London], Ann. Rpt. Agr. Ed. and Research, 1903–4, pp. 68–72*).—At the University College of North Wales sheep-breeding experiments were continued along the same lines as in previous years (E. S. R., 15, p. 805). Mountain ewes were crossed with Southdown, Kerry Hill, and Leicester rams. The Southdown crossbred lambs averaged 70 lbs. in weight when sold at the age of about 9 months, being, according to the author, somewhat riper and in better condition than the others. The Kerry Hill cross weighed on an average 66 lbs. and the Leicester cross 74 lbs.

In a test of the value of various crosses with crossbred ewes for the production of fat lambs, Hampshire-down, Leicester, Lincoln, Suffolk-down, and Wiltshire rams were used. The best results were obtained with the Hampshire cross. The Leicester and Lincoln crosses were regarded as only moderately successful. The Suffolk-cross lambs reached good weight and were of good quality, but were slow in fattening. The Wiltshires did not give as good results as usual, probably owing to the fact that the weather was cold.

Welsh mountain ewes were crossed with Southdown and Wiltshire rams. Judging by the length of time required to feed the lambs for market and the average live weight when sold, the results were in favor of the Southdown cross, though the differences were less marked than in the last year's test.

Sheep-breeding experiments for the production of early fat lambs, P. H. Foulkes and W. Vaughan (*Harper-Adams Agr. Col. Bul. 1, pp. 8*).—Welsh ewes were crossed with Welsh, Southdown, and Shropshire rams, with a view to determining the most satisfactory crosses for breeding lambs for market. Owing partly to the

larger proportion of lambs reared and sold, the best results were obtained with the pure Welsh breed. At lambing times the Welsh lambs were hardier and stood conditions of the weather, etc., better than the heavier crossbreeds and were also ready for market about 3 weeks earlier than the others. Additional experiments are considered necessary before definite conclusions can be drawn.

Breeding for fat lambs, W. T. LAWRENCE (*Agr. Dept. Durham Col. Sci. Ann. Rpt., 12 (1903), pp. 78-80*).—In experiments at Newton Rigg, an Oxford-down, a Wensleydale, and a Border Leicester ram were each crossed with 19 Cheviot Border Leicester ewes.

The average weight of the lambs when sold ranged from 74.8 lbs. with the Oxford-down cross to 77.2 lbs. with the Wensleydale cross. The average value per pound with the Oxford-down cross was 9.66 cts. and with the Wensleydale and the Border Leicester cross 9.48 cts. The Oxford-down lambs matured most quickly for market and cost less for maintenance than the others, consequently their dams could be fattened and sold more quickly than the other ewes. When the earlier maturity of the Oxford-down lambs is taken into account, according to the author, the results obtained with them must be considered the most satisfactory.

Feeding experiments with lambs, 1903-4, B. C. BUFFUM (*Wyoming Sta. Bul. 64, pp. 20, pls. 3*).—In continuation of a test previously reported (E. S. R., 14, p. 382), a lot of 60 lambs was pastured on 11.6 acres of field peas raised on sod without irrigation, while 4 similar lots were fed alfalfa, turnips, and linseed meal, with and without corn; alfalfa and corn; and alfalfa with a mixture of barley, wheat, and oil meal. All the lots contained both large lambs and small scrubs.

The test proper covered 100 days, being preceded by a preliminary period in which all the lots received uniform treatment. On field peas the average gain per head was 24.9 lbs. With the other lots the gains ranged from 18.7 lbs. on alfalfa, turnips, and oil meal to 27.2 lbs. on alfalfa, turnips, corn, and oil meal. With all the lots the digestible nutrients per pound of gain ranged from 0.83 lb. protein and 4.04 lbs. carbohydrates and fat on the alfalfa, turnips, corn, and oil meal ration, to 1.43 lbs. protein and 6.65 lbs. carbohydrates and fat on field peas.

The gain was most expensively made with the lot fed peas, costing 6.22 cts. per pound, and most cheaply with the lot fed alfalfa, turnips, and oil meal, costing 3.35 cts. per pound. When slaughtered the largest proportion of dressed carcass, 47.8 per cent, was noted with the lot fed corn and oil meal, and the smallest, 43.3 per cent, with the lot fed oil meal in addition to coarse fodder.

The principal conclusions follow:

The lot fed field peas harvested the crop, made better gains, and went to market in better condition than the lot fed corn and alfalfa.

"It is possible to fatten lambs without grain on a cheap ration of alfalfa, turnips, and oil meal, and such rations will be further investigated.

"A complete and well-balanced ration of alfalfa, turnips, corn, and oil meal gave the largest gains on the smallest actual amount of nutrients in the food.

"There are probably better and more practical rations for fattening lambs in Wyoming than the alfalfa and corn ration commonly used.

"Combinations of wheat and barley fed alternately in ten-day periods did not give the best results. Fed in this manner, the lambs ate less grain and made smaller gains than on other grain rations.

"Under our conditions it will not pay to feed small, stunted lambs on full grain rations for short periods."

Sheep-feeding experiment, W. BRUCE (*Edinb. and East of Scot. Col. Agr. Bul. 4, pp. 1-17, 33*).—Using 6 lots of 38 sheep each, a test was undertaken to learn the most profitable feeding stuffs to use with a basal ration of cut Swedish turnips ad libitum with hay in the winter feeding of sheep, and to determine whether the use of concentrated feeding stuffs effected any saving in the daily consumption of turnips.

One of the lots was given hay and turnips only, and the others were fed linseed cake, Bombay cotton-seed cake, and grain mixtures containing Bombay cotton-seed cake or decorticated cotton-seed cake. In the 93 days of the test the total gain on turnips and hay alone was 1,040 lbs. and the gross cost per pound of gain 7.32 cts. In the case of the lots fed grain in addition to the basal ration the gain ranged from 1,252 lbs. on wheat, decorticated cotton-seed cake, and cotton seed to 1,461 lbs. on linseed cake and the gross cost of a pound of gain from 6.70 cts. on Bombay cotton-seed cake to 8.22 cts. on a mixture of wheat, decorticated cotton-seed cake, and cotton seed.

When dressed the weight was very uniform, being about 51 per cent of the live weight in every case. Considering the test as a whole the conclusion was drawn that Bombay cotton-seed cake was the most satisfactory of the concentrated feeds tested. An examination of the dressed carcasses showed that the animals fed this material were very superior to the others in appearance. The greatest financial return per acre of turnips was noted with the lots fed the Bombay cotton-seed cake.

On the presence of cotton-seed oil in lards from hogs fed upon cotton-seed meal, A. D. EMMETT and H. S. GRINDLEY (*Jour. Amer. Chem. Soc., 27 (1905), No. 3, pp. 263-270*).—The presence of vegetable oil and cotton-seed oil was shown by several tests with samples of lard from pigs fed cotton-seed meal.

It is evident, according to the authors, "first, that the lards contain a vegetable oil, and second, if we agree with the most recent authorities, they contain 3 distinct constituents of cotton-seed oil. Hence, it seems safe to say that a part at least of the oil existing in cotton-seed meal is absorbed, in the case of hogs fed upon this ration, by the animal body and transmitted in its unaltered condition to the fat cells."

Feeding farm horses, L. A. MERRILL (*Utah Farmers' Inst. Ann. 1904, pp. 43-49*).—Information regarding the feeding and management of horses is presented, some of the data being based on the experience of the Utah Station. The principal points are thus summarized:

"The amount of hay fed to horses on the average Utah farm can be very materially reduced, and if this be done it will result in (a) great financial saving to the State, and (b) the elimination of many digestive disorders to which our horses are subject.

"Horses should receive most of the hay at night, very little in the morning, and none at all for the noon meal. Always water before feeding. Oats make the best grain feed for horses, but these can be replaced by bran and shorts, or supplemented by corn.

"Carrots and sugar-beet pulp have a marked beneficial effect in horse feeding, serving as a laxative and a tonic, as well as enabling the horse to digest the hay and grain more effectively. Horses may eat as much as 40 lbs. of sugar-beet pulp daily."

Poultry culture in Minnesota, C. S. GREENE (*Minnesota Sta. Bul. 91, pp. 239-258, figs. 2*).—On the basis of personal experience, general questions of feeding, raising, and marketing poultry are discussed. One section of the bulletin is devoted to turkeys.

Poultry under confinement, J. WITHYCOMBE (*Oregon Sta. Bul. 84, pp. 8, fig. 1*).—Data are given regarding the financial returns from a flock of 24 White Plymouth Rock pullets, 5 old hens, and a cock, the test covering 1 year. The total number of eggs produced was 3,529.

Seventy-five chickens were raised from a total of 100 eggs set. "The low percentage of hatch of home-produced eggs was evidently due to too many hens to one male." Although the cost of feed was abnormally high, the flock yielded a profit of 180 per cent on the original investment of $15. "This test demonstrates conclusively that a small flock of poultry may be profitably kept under confinement; [and] that early hatched pullets are more profitable than late hatched ones."

Winter egg production, J. DRYDEN (*Utah Farmers' Inst. Ann. 1904, pp. 84-98, fig. 1*).—Feeding, care, and management of hens and construction of poultry houses

are among the subjects treated, the material presented being in part a summary of the poultry work carried on at the Utah Station.

The dry feeding of chickens, E. Brown (*Jour. Bd. Agr.* [*London*], *11* (*1905*), *No. 11, pp. 683, 684*).—The author states that experiments and observations extending over several seasons have led to the conclusion that the high mortality of artificially reared chickens during the first 10 or 20 days was due to want of exercise. Substituting dry feeds for wet feeds insured exercise and reduced the mortality to a minimum. The dry grains were scattered on the floor of the breeder or brooder house among chaff, where the chickens had to scratch to find them. Different grain mixtures which have been used with success at the Reading University College Poultry Farm are given.

The modifications of the respiratory quotient due to age, especially with reference to chickens and ducks, L. Mayer (*Trav. Lab. Physiol. Inst. Solvay, 6* (*1904*), *No. 3; abs. in Zentbl. Physiol., 18* (*1904*), *No. 21, p. 679*).—When expressed in the form of a curve the excretion of carbon dioxid by chickens and ducks in the first month after hatching is very similar to that which the author has reported for mammals. The excretion of carbon dioxid is very large in the first days after hatching, but diminishes rapidly in the first week, and then gradually, reaching its normal value when the birds are fully developed.

DAIRY FARMING—DAIRYING.

Investigations on the influence of irritating substances on the consumption and digestibility of food, and the secretion of milk with rations deprived of these substances and with normal rations, G. Fingerling (*Landw. Vers. Stat., 62* (*1905*), *No. 1-3, pp. 11-180*).—In studying the influence of irritating, stimulating, or condimental substances upon the consumption and digestibility of food and the secretion of milk, 2 series of experiments were conducted, one in which the food was nearly or entirely deprived of irritating substances, and one in which such materials were added to a normal ration. The experiments were made with rabbits, goats, and sheep. Among the substances under investigation were fenugreek, fennel, sugar, anise, hay extract, malt sprouts, and several proprietary preparations.

The addition of irritating substances was found to increase the consumption of food and the secretion of milk, but only when the ration was extremely poor in or entirely free from such substances, which would rarely be the case in practice. With normal rations the addition of condimental substances was entirely without effect. Under certain conditions it is believed that the addition of such substances to normal food may be injurious by causing a chronic catarrhal inflammation of the digestive tract. Contrary to views generally held, the irritating substances tested did not increase the digestibility of the food. This was true whether the food was originally poor or rich in these substances.

As regards the practical application of these results, it is considered clear that only in such cases where the food is deprived of its normal constituents, as, for example, hay which has been subjected to the effects of rain, can these substances be used to advantage. With normal feeding stuffs their addition is not only unprofitable but sometimes injurious. Cases where their use would be profitable are believed to be very rare, and then it is believed to be better to use seeds like fennel, anise, fenugreek, and caraway than proprietary mixtures consisting for the most part of such seeds and neutral substances. The author believes that good aromatic hay with salt is the best stimulating material.

Scant v. ample rations for dairy cows, H. Isaachsen (*Ber. Norges Landbr. Höiskoles Virks., 1903-4, pp. 249-259*).—This is a report of an experiment conducted during a full year with 19 cows, 4 of which were fed a scant ration of 2½ kg. cut straw, 8 to 9 kg. hay, and 1 kg. ground corn per head daily, while the other cows

received rations consisting of hay, straw, and silage, with 2 to 3 kg. of concentrated feed.

On an average 100 lbs. of milk was produced by lot 1 from 103 "food units," and by lot 2 from 84 "food units." The average milk production for the year was for lot 1, 1,765 kg., and for lot 2, 2,303 kg., while the average profit for the year for lot 1 was $11.34 per head, and for lot 2 $15.93. Several factors tended to render direct comparisons of the results of doubtful value, but on the whole the greater economy of the more liberal system of feeding of the second lot is apparent from the larger production of the cows and the larger increase in body weight during the year.—F. W. WOLL.

Feeding sugar to milch cows, E. A. BOGDANOV (*Izv. Moscov. Selsk. Khoz. Inst. (Ann. Inst. Agron. Moscou), 10 (1904), No. 3, pp. 471–504*).—Two cows were used in each of 6 experiments, covering 3 periods of 10 days each. During the middle period sugar was fed in addition to the normal ration or as a substitute for a portion of either the nitrogen-free extract or proteids. The experiments which were conducted in the fall and spring indicated that the sugar was profitably utilized only when fed in rations containing a normal amount of proteids. The experiments conducted in the summer showed that linseed cake was more valuable than sugar.—P. FIREMAN.

Effect of corn silage on the flavor of milk, W. J. FRASER (*Illinois Sta. Bul. 101, pp. 644–646*).—In order to test the effect of corn silage on the flavor of milk, the university dairy herd was divided into 2 lots, one of which was fed 40 lbs. of corn silage per cow per day, while the other lot was fed only clover hay and grain.

The milk from each lot was standardized to 4 per cent and otherwise cared for in exactly the same manner. In all 372 samples from each lot were submitted to ladies, men of the faculty, and men students for an opinion as to any difference in the flavor of the 2 samples, anything objectionable about either, and any preference. The results showed that 60 per cent preferred silage milk, 29 per cent nonsilage milk, and 11 per cent had no choice. When the silage was fed at the time of milking, the percentage in favor of silage milk was much higher than when the silage was fed one hour before milking or after milking.

Five samples of each lot were sent to milk experts in different cities, three of whom preferred silage milk, one nonsilage, and one had no choice. No complaint was received from a hotel to which silage milk was delivered for a period of 1 month. On the whole it was apparent that the greater number of people were able to distinguish between the 2 kinds of milk, but found nothing objectionable about either kind. It is suggested that only good silage should be used for dairy cows and that all feeds of this nature should be fed after milking in order to avoid any unpleasant flavor in the milk.

Influence of feeding sesame cake on the properties of butter fat, J. DENOËL (*Bul. Agr. [Brussels], 21 (1905), No. 2, pp. 182–192*).—In view of the requirements in certain countries that sesame oil shall be added to margarin, the author discusses the reliance that may be placed upon the Baudoin reaction for detecting this oil, and reports experiments to determine whether feeding sesame cake can communicate to butter the reaction of sesame oil.

The experiments included 16 cows and comprised in all 31 tests, in none of which was the least coloration obtained, indicating that none of the sesame oil was transmitted to the milk. Contradictory results which have been obtained by other investigators are noted.

On the different portions of the milking with application to the Hegelund method, H. SVOBODA (*Chem. Ztg., 29 (1905), No. 34, pp. 468–474*).—The literature relating to the composition of milk at different stages in the process of milking is reviewed, and experiments with 5 cows representing 2 breeds are reported in detail.

The yield of milk from the different quarters of the udder was found to vary considerably, the posterior quarters being much more productive than the anterior. Owing to the position of the milker on the right side, and consequently the more intensive manipulation of the right half of the udder this half was found to be more productive than the left half.

The generally held view that the percentages of fat and solids increase from the beginning to the end of milking, while the specific gravity decreases, is not believed to be true. This is, however, the case for a single quarter, for a half of the udder when the 2 quarters are milked simultaneously, or even for all 4 quarters when milked at the same time. In such cases the fat and total solids increase from the beginning to the end of milking, while the proteids, ash, and milk sugar decrease almost uniformly.

While there is practically no difference in the proportion of proteids, ash, and milk sugar from the beginning to the end of milking, such variations as do exist are more marked in the case of proteids and ash than milk sugar. The greater the yield of milk the more marked are the variations mentioned. Where the different quarters of the udder are milked in succession the fat content of the different portions of the mixed milk varies irregularly.

The influence of milking on the composition of milk, M. POPP (*Molk. Ztg., 19 (1905), No. 20, pp. 493, 494*).—This is a discussion of investigations along this line, especially those of Lepoutre (E. S. R., 15, p. 906) and Svoboda (see above). In experiments conducted in Russia it is noted that the yield of milk of cows of 4 different breeds during 10 days when the animals were regularly cleaned was 7 per cent greater than when they were not cleaned.

The chemical composition of milk in Milan, 1902–3, C. BERTOCCHI (*Milchw. Zentbl., 1 (1905), No. 5, pp. 211–215*).—In continuation of the work of Billitz (E. S. R., 16, p. 1013), the author reports the results of analyses of the milk of 24 herds, representing 2,127 cows, in the region of Milan, and of 31 herds, representing 2,304 cows, in the neighborhood of Lokate-Triulzi.

The period covered was from May, 1902, to April, 1903. The average composition of the milk of the 24 herds was as follows: Specific gravity 1.0317, fat 3.61 per cent, solids-not-fat 8.91, and total solids 12.52; and of the 31 herds, specific gravity 1.0316, fat 3.70 per cent, solids-not-fat 8.91, and total solids 12.61. As compared with the earlier analyses the results show a slight improvement in the composition of the milk. Often, however, the total solids fell below 12 per cent and the solids-not-fat below 9 per cent, the standard adopted in Milan.

The milk supply of twenty-nine southern cities, C. F. DOANE (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 70, pp. 40*).—A detailed account, based upon personal investigation, is given of the milk supplies of Richmond, Norfolk, Portsmouth, Newport News, Lynchburg, Danville, Wilmington, Raleigh, Greensboro, Charleston, Columbia, Spartanburg, Atlanta, Savannah, Augusta, Macon, Jacksonville, Pensacola, Montgomery, Birmingham, Mobile, Vicksburg, Meridian, Natchez, New Orleans, Baton Rouge, Memphis, Chattanooga, and Knoxville.

In addition the author discusses in a general way the dairy situation in the South, the consumption of milk in southern cities, the methods employed in the handling of milk, milk and dairy inspection, and peculiar conditions in the seacoast cities, and makes suggestions for the improvement of existing conditions.

The consumption of milk in southern cities was found to be small. The average daily amount consumed per capita in Richmond was found to be less than $\frac{1}{2}$ pt., while in Mobile it was less than $\frac{1}{10}$ pt. It was also ascertained that the sale of cream was exceedingly light.

Two evils considered by the author as characteristic of the dairy industry of the South are the keeping of cows in small inclosures within the city limits, and the

delivery of warm milk. Many suggestions are made looking toward the improvement of milk supplies in the South.

The production of certified milk on the Biltmore farms, M. N. Ross (*Pure Products, 1* (*1905*), *No. 6, pp. 300–304*).—Notes are given on the dairy herd at Biltmore and on the methods employed in producing and marketing milk.

The sanitary production and sale of milk, Plehn (*Österr. Molk. Ztg., 12* (*1905*), *No. 8, pp. 103, 104; Milch Ztg., 34* (*1905*), *No. 19, pp. 227–229; 20, pp. 241–243*).—This is a brief general discussion of this subject.

Stable hygiene, R. Bissauge (*Indus. Lait.* [*Paris*], *30* (*1905*), *No. 22, pp. 257, 258*).—This is a brief discussion of stable hygiene with special reference to dairy cows.

Variation in the composition of cows' milk, C. Crowther (*Jour. Agr. Sci., 1* (*1905*), *No. 2, pp. 149–175*).—A résumé of experimental work in Great Britain conducted by the agricultural institutions and societies since 1900.

While the greater number of the investigations upon which this article is based have been noted from time to time in the Record, the article also contains additional information secured from private communications. The following factors are discussed as regards their influence upon the composition of milk: Interval between successive milkings, day and night, age, period of lactation, season of the year, food, manner of feeding, weather, pasturing *v.* housing at night in autumn, and sexual excitement.

Data on the composition of milk from different quarters of the udder, on the average composition of milk, and on the limits of variation in composition of mixed milk are also summarized.

Contribution to the bacteriology of milk, S. Severin and L. Budinoff (*Centbl. Bakt.* [*etc.*], *2. Abt., 14* (*1905*), *No. 15–16, pp. 463–472*).—Determinations were made of the number of bacteria in mixed milk and in samples of the same milk taken immediately after separation or clarification, pasteurization, cooling, and bottling.

As compared with the number of bacteria in mixed milk the percentages after separation, pasteurization, cooling, and bottling were respectively 182.8, 0.017, 0.076, and 0.030. In another series of experiments in which the milk was treated in exactly the same manner except that the pasteurizing apparatus was not heated, the percentages after separation and cooling were 232.1 and 246.8 as compared with the number in the mixed milk.

The cause of the large increase in the number of bacteria, due apparently to passing through the separator, was investigated, the results of the experiments showing that this increase could not be attributed to contamination from the air or the apparatus, nor to the multiplication of the bacteria during the brief interval in which the milk was held at 30° C. A further investigation of this subject is contemplated.

Studies were also made of the number and kinds of bacteria in pasteurized and unpasteurized milk. In the pasteurized milk spore-forming and peptonizing bacteria were in the minority, the far greater number consisting of vegetative forms indifferent toward milk. Lactic-acid bacteria were not found in the milk immediately after pasteurization, but were found in the milk at later stages in the process of cooling and bottling. Of the bacteria gaining access to the milk after pasteurization none were spore-forming.

When the pasteurized milk was preserved at 9 to 11° C. for 14 to 27 hours, the spore-forming bacteria played no essential rôle, while the bacteria gaining access to the milk after pasteurization developed with much greater energy. It is considered apparent that the bacteria resisting pasteurization were so reduced in vitality that at least in the interval of 27 hours they were not able to multiply with the rapidity of the bacteria which were not subjected to the unfavorable influence of heat. Similar results were also obtained by means of plate cultures. Colonies on plates prepared immediately after pasteurization developed much more slowly than colonies on plates prepared at later periods.

Gas-producing bacteria and their effect on milk and its products, F. C. Harrison (*Ontario Agr. Col. and Expt. Farm Bul. 141, pp. 7, figs. 6*).—Practical points brought out in connection with a study of 66 varieties of gas-producing bacteria isolated from milk are discussed briefly in this bulletin.

Bacteriological examinations of the milk from a number of farms showed on an average the presence of nearly 15,000,000 bacteria per cubic centimeter, of which over 235,000 were gas producing. The percentage of gas-producing bacteria in 27 examinations made varied from 0.04 to 34.2 per cent. In studying the source of these gas-producing organisms in milk it was ascertained that they were occasionally present in the udders of certain cows, on the hair of the animals, in clean, dry milk cans, in watering troughs, on flies present in the stable, and in manure.

The gas-producing bacteria were found to be readily killed at temperatures of 137 to 146° F. for 10 minutes. While they were destroyed by immersion for 10 minutes in a 2 per cent solution of ammonia or soda washing powders kept at 140°, it is believed that these powders are scarcely more effective than hot water, except as they help to remove the dirt in washing.

It was found that by continued growth in milk the gas-producing bacteria increased their power of fermenting milk sugar. In one instance the increase in gas production noted was from 26 to 62 per cent. In general the development of lactic-acid bacteria tended to check the growth of the gas-producing forms.

The injurious effects of the gas-producing bacteria were shown in butter and cheese making experiments.

A comparative study of sixty-six varieties of gas-producing bacteria found in milk, F. C. Harrison (*Rev. Gén. Lait, 4 (1905), Nos. 12, pp. 265–275; 13, pp. 289–297; 14, pp. 315–328; 15, pp. 337–351; Centbl. Bakt. [etc.], 2. abt., 14 (1905), Nos. 12–13, pp. 359–374; 15–16, pp. 472–480*).—This is a detailed report of the bacteriological investigations upon which the above bulletin is based.

The author proposes a classification of the different varieties which were stated to show every imaginable modification between *Bacillus coli* and *B. lactis aerogenes*, which were taken as extremes. The neutral red test did not appear to be of value in separating members of the coli group, and the agglutination test showed only a limited value in the identification of closely related varieties. A bibliography is appended.

On the preservation of milk with hydrogen peroxid, E. Baumann (*München. Med. Wchnschr., 52 (1905), No. 23, pp. 1083–1088*).—After citing objections which have been raised to the pasteurization and sterilization of milk for infant feeding and reviewing briefly some of the literature relating to the use of formalin and hydrogen peroxid for this purpose, the author reports several series of experiments with the latter substance.

In no instance were all the bacteria in market milk destroyed by hydrogen peroxid added in quantities ranging from 0.35 to 2 parts per thousand, the milk being heated to 45 to 50° C. and kept at that temperature for 2 to 3 hours. The number of bacteria, however, was always greatly reduced and spontaneous curdling of the milk delayed for several days. The reaction for hydrogen peroxid was usually absent at the end of treatment unless the quantity added exceeded 0.54 part per thousand, when a positive reaction was obtained for days.

Market milk treated with hydrogen peroxid in the proportion of 0.42 : 1,000 showed 60, 2,220, and 26,400 bacteria per cubic centimeter at the end of 2, 5, and 7 days, respectively, while milk which had been obtained under rigid aseptic precautions was completely sterilized by the same treatment.

Typhoid, cholera, and dysentery bacilli added to milk sterilized by heating were destroyed in all cases by hydrogen peroxid in the proportion of 0.35 : 1,000, the milk being heated to 45 to 50°. Typhoid bacilli were not all destroyed by hydrogen

peroxid in the proportion of 0.18:1,000 and a temperature of 45° or 0.35:1,000 at room temperature.

Tubercle bacilli were also added to sterilized milk, which was then treated with hydrogen peroxid in the proportion of 0.35:1,000. Inoculation experiments with guinea pigs gave negative results as regards infection. It was concluded as the result of 2 series of experiments that both bacteria and enzyms in milk are capable of decomposing hydrogen peroxid.

Treatment with hydrogen peroxid was found to lengthen materially the time required for coagulation of milk with rennet extract, and also to bring about certain changes in the character of the curd. In artificial digestion experiments the pepsin-hydrochloric-acid solution seemed to act more rapidly and energetically on the samples treated with hydrogen peroxid than on raw milk. The results of the digestion and coagulation experiments are therefore considered as offering no objection to the use of hydrogen peroxid in milk. Aside from its possible use in infant feeding, milk preserved with hydrogen peroxid is believed to be well suited to use in the army and navy and in the Tropics.

In the practical application of hydrogen peroxid to the preservation of milk, it is pointed out that every precaution should be taken to prevent contamination of milk during milking, that milk should be treated immediately after milking before a multiplication of bacteria has taken place, and that the 30 per cent hydrogen-peroxid solution can be used to avoid dilution of milk.

On the question of the preservation of milk with formaldehyde, especially for the purpose of infant feeding, L. Schaps (*Ztschr. Hyg. u. Infectionskrank., 50 (1905), No. 2, pp. 247–264, figs. 7*).—Some of the literature of this subject is briefly reviewed.

Experiments are reported which show the length of time that formalin in the proportions of 1:10,000 and 1:5,000 delays the souring of milk at room and incubator temperatures. The author claims that formalin in the proportion of 1:10,000 renders the milk objectionable on account of taste and that in the proportion of 1:40,000 it is still distinctly recognizable, which is contrary to the statement of Behring that milk treated with formalin in the proportion of 1:4,000 could not be distinguished from untreated milk.

Samples of raw milk and milk preserved with formalin in the proportion of 1:10,000 and 1:5,000 were inoculated with *Staphylococcus pyogenes albus* and kept at room temperature for 12 hours. Plate cultures were then made and examined after remaining 24, 48, and 72 hours in the incubator. When examined at the end of 24 hours many of the plates showed colonies only in the case of milk not treated with formalin, but when examined at a later period it was apparent that formalin had not destroyed the staphylococci.

Formalin checked the development of the lactic-acid bacteria to a much greater extent than that of the staphylococci. As determined by inoculation experiments with guinea pigs, formalin in the amounts above mentioned failed to destroy tubercle bacilli added to raw and sterilized milk.

The history and post-mortem findings in the case of an infant which had been fed milk preserved with formalin in the proportion of 1:10,000 are reported, but the data warranted no positive conclusion as to the influence of formalin. On the evidence so far obtained the author objects to the use of formalin as well as to that of other preservatives in milk.

Milk preserved with formalin and the relation of formalin to certain species of bacteria, P. Sommerfeld (*Ztschr. Hyg. u. Infectionskrank., 50 (1905), No. 1, pp. 153–164*).—The author found that formalin added to fresh milk in the proportion of 1:5,000 or 1:10,000 was capable of hindering to a marked extent the development of bacteria.

The germicidal power of formalin was most marked when the milk was held at temperatures of 10 to 15° C. At 20° and above the number of bacteria in milk preserved with formalin at the end of 24 hours was scarcely less than that in control samples. At 37° formalin showed no appreciable effect in retarding the development of bacteria. On the contrary, when milk was kept at 7 to 8° the addition of formalin in the proportion of 1:10,000 reduced the number of bacteria in 6 days in one instance from 2,160 to 222 bacteria per cubic centimeter. At low temperatures the bactericidal action of formalin was equally marked when the original bacterial content of the milk was high.

While valuable as a means of preserving milk samples for analytical purposes, formalin is believed to be no better suited for preserving milk for human consumption than any other chemical preservative. Cleanliness in milking, immediate cooling, and keeping at a temperature below 10° C. are considered the best means of preserving milk for human use.

In a second series of experiments sterile milk and bouillon preserved with formalin were inoculated with various species of bacteria. The virulence of diphtheria bacilli in milk treated with formalin in the proportion of 1:5,000 and kept at room temperatures for 24 hours and at 37° for a second period of 24 hours was not impaired. Typhoid bacilli added to milk also resisted formalin in the proportion of 1:5,000. In bouillon formalin in the proportion of 1:10,000 showed no inhibitory influence on the development of the coli bacillus. Typhoid bacilli in bouillon were completely destroyed in 24 hours at 21° by formalin in the proportion of 1:5,000 but not the proportion of 1:10,000. *Bacillus pyocyaneus* in milk or bouillon was not destroyed at 37° by formalin in the proportion of 1:10,000 or 1:5,000.

On the passage of antibodies into the milk and their absorption through the digestive tract, DE BLASI (*Centbl. Bakt.* [*etc.*], *1. Abt., Ref., 36* (*1905*), *No. 12–13, pp. 353–355*).—In 2 series of experiments cats and rabbits were immunized passively by means of injections of diphtheria antitoxin and antidysentery serum, and actively by means of cultures of the dysentery bacillus and typhoid bacilli.

The passive immunity of the mother was not sufficient to protect the nursing offspring from the results of inoculation with bacterial cultures. In the cases of active immunity the results showed that the antibodies not only passed over into the milk but were absorbed in the digestive tract in sufficient quantities to neutralize the effect of bacterial injections. A marked difference was, therefore, apparent between the groups actively and passively immunized.

This is published as a preliminary communication, and contains a brief discussion of the literature of the subject.

On the passage of the agglutinins and antitoxins of tuberculosis into milk and their absorption by way of the alimentary tract, F. FIGARI (*Riforma Med., 21* (*1905*), *No. 14; abs. in Jour. Amer. Med. Assoc., 44* (*1905*), *No. 22, p. 1818*).—The author found that the agglutinins and antitoxins pass into the milk of cows and goats actively immunized against tuberculosis, and into the milk of rabbits passively immunized; and furthermore, that the agglutinins and antitoxins in the milk of immunized animals are absorbed in the digestive tract of calves and young goats born of nonimmunized mothers, and are able to excite the formation of other agglutinins and antitoxins.

Outbreak of sore throats due to infected milk (*Jour. Amer. Med. Assoc., 44* (*1905*), *No. 25, p. 1996*).—A brief account is given of an outbreak of septic sore throat involving from 500 to 600 persons, the cause of which was traced to the milk of a cow affected with mastitis.

On the fat content of human milk, P. REYHER (*Jahrb. Kinderheilk., 61* (*1905*), *No. 4, pp. 601–614*).—The author shows that the method of obtaining the samples analyzed has much to do with the marked variations in reported data. In some instances a difference of over 6 per cent was observed in the fat content of the first

and last portions of milk obtained. The method employed by the author is described, some data secured are reported, and a bibliography of the subject is added.

On the fat in human milk, ENGEL (*Ztschr. Physiol. Chem., 44 (1905), No. 3-4, pp. 353-365, figs. 10*).—The literature of this subject is reviewed and determinations of the iodin number of the fat in the milk of 4 women are reported.

The average determinations for each of the 4 subjects were 44, 54, 43.6, and 43.3. The results indicated that in most instances the iodin numbers would lie within the limits reported by Laves and Sauvaitre, namely, 44.5 and 43.37. The conclusion is drawn that the iodin number varies within moderate limits with the different individuals and daily with the same individual.

Productive capacity of the Friesian milch sheep on the moors of Northwest Germany, A. KIRSTEN (*Milchw. Zentbl., 1 (1905), Nos. 4, pp. 145-155; 5, pp. 193-202*).—Detailed data are given showing the yield and composition of the milk of 3 sheep during one lactation period each.

The decrease in the yield of milk was gradual from the beginning to the end of the lactation period. The fat content of the milk remained nearly uniform during the first few months, then increased rapidly and became twice as high in the last month as in the first. The specific gravity decreased in the first month, but increased above that at the beginning toward the close of the lactation period. The highest fat content observed was 14.88 per cent and the highest specific gravity 1.0478. The average percentages of fat in the milk of the 3 sheep for the entire lactation periods were 5.58, 6.81, and 6.97. Marked daily variations were sometimes observed.

Information concerning the milch goats, G. F. THOMPSON (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 68, pp. 87, pls. 16, figs. 7*).—This is a compilation of available information concerning milch goats, the publication being designed to answer questions received by the Bureau concerning various phases of the industry.

Among the many subjects discussed in this connection are the economy of goat keeping, characteristics and composition of goat's milk, period of lactation, methods of milking, butter and cheese made from goat's milk, care and management of goats, diseases of goats, feeding and breeding of goats, points to be observed in purchasing goats, prices of milch goats, goat's flesh as food, milch goats as brushwood destroyers, and breeds of milch goats. Notes are given on The Milch Goats of Switzerland by F. S. Peer, and on Goats in Norway and Sweden by Caroline Harrison.

The struggle against tuberculosis in Denmark, pasteurization, and the use of pure cultures in Danish dairies, M. BEAU (*Ann. Inst. Nat. Agron., 2. ser., 4 (1905), No. 1, pp. 25-96, figs. 9*).—This is a report upon studies in Denmark relating to the control of bovine tuberculosis, ripening of cream, pasteurization, and the employment of pure cultures in butter making.

On the mechanical splitting-up of the fat globules in cows' milk, C. BARTHEL (*K. Landtbr. Akad. Handl. och Tidskr., 43 (1904), No. 6, pp. 401-408*).—The author furnishes evidence that the fat globules in cows' milk are split up by strong agitation, like that taking place in pasteurizing machines where the milk is stirred at a considerable speed, and also shows that the Adams method of determining fat in milk gives too low results, the percentages of fat found by the Gottlieb method being uniformly higher.—F. W. WOLL.

Various dairy trials, F. FRIIS and H. P. LUNDE (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög [Copenhagen], 57 (1905), pp. 31*).—*Trials with aeration of cream.*—The trials were made with two forms of apparatus for aerating cream. Butter made from aerated and non-aerated cream was judged twice, with an intermission of 14 days. In 34 comparative trials the score for the butter made from aerated cream was higher than that from non-aerated cream in 6 cases, lower in 5 cases, and the same in 23 cases. In the second scoring these figures were changed to 9, 12, and 13, respectively.

The results show that no difference was, in general, found in the quality of the butter from aerated and from non-aerated cream, the trials thus corroborating the results of earlier investigations made with sweet milk (E. S. R., 13, p. 179). The quality of the butter was found to be somewhat impaired by the direct pumping of air into the cream, presumably because oxygen is thus supplied to the aerobic bacteria in the cream which tend to deteriorate the butter.

Trials with Ulander's milk strainer.—The cream separated from milk strained by means of an ordinary strainer and by Ulander's strainer was churned under similar conditions and the butter scored. In the first scoring the butter obtained from the milk strained by Ulander's strainer scored the same as the control lot in 29 cases out of 36, higher in 5 cases, and lower in 2 cases. In the second scoring these figures were changed to 24, 3, and 9, respectively. On the average there was a difference of only 0.1 of a point on either scoring (total score 15), showing that the method of straining the milk did not affect either the grade or the keeping quality of the butter made therefrom.

Trials with the Disbrow churn.—The preliminary report of the comparative trials with the common Danish (Holstein) and the Disbrow combined churn and worker has already been referred to (E. S. R., 16, p. 917). The report here given furnishes a full account of the experimental data, from which the following averages for the Danish and Disbrow churns, respectively, for the 25 different trials are taken:

Churning temperature at the beginning (Danish) 14.2° C., (Disbrow) 14.2°; at the end, 15.4 and 15.3°; length of churning, 25.1 and 35 minutes; revolutions per minute, 131.7 and 28.4; fat in butter milk, 0.43 and 0.45 per cent; water in butter, 13.87 and 14.02 per cent. The score of butter on both first and second scorings was 0.2 point in favor of the Disbrow churn, on a total score of 15. The horsepower required in 3 trials was 1.3 for the Danish churn and 3.3 for the Disbrow churn. The horsepower hours per 1,000 lbs. cream in 2 trials was for the Danish churn 1.35 and for the Disbrow churn 1.25, and in a third trial 2.2 and 1.2, respectively.—F. W. WOLL.

On clean skimming of milk at different temperatures, F. FRIIS and E. HOLM (*Ber. K. Vet. og Landbohöjskoles Lab. Landökonom. Forsög* [*Copenhagen*], *56* (*1905*), *pp. 24–29*).—The general practice in Danish creameries in the early nineties was to skim the milk at 30° C., but since the introduction of the pasteurization method in the creameries high skimming temperatures have been gradually adopted, as the skim milk and the cream are now always pasteurized after separation.

An investigation conducted last winter showed that of 907 creameries 4.7 per cent warmed the milk to 30 to 35° C. before separating, 21.8 per cent to 36 to 40°, 45.8 per cent to 41 to 45°, 21 per cent to 46 to 50°, 5.6 per cent to 51 to 55°, and 1.1 per cent to 56 to 68°, the average skimming temperature for all creameries being 43° C. Analyses of the separator skim milk taken at a number of creameries from different styles of separators showed that the fat content of the milk was lowest at the higher skimming temperatures.

The following average results have been calculated from tables given in the report:

Effect of temperature of skimming on fat content of skim milk.

Skimming temperature (degrees C.)	31	35	40	45	50	55	60	65
Number of analyses	2	7	11	12	8	12	7	2
Average percentage of fat	0.179	0.161	0.137	0.123	0.110	0.101	0.103	0.102

The former of the two series of determinations conducted were made by the extraction method, hence the results are in all probability slightly low, on the average, 0.05 per cent. On basis of the results obtained it is recommended to heat the milk to about 60° C. in the forewarmer, prior to separation.—F. W. WOLL.

A new centrifugal churn, G. RAGONDET and M. HARDY (*Ann. Gembloux, 15* (*1905*), *No. 6, pp. 314–318, fig. 1*).—A centrifugal churn exhibited at the agricultural

exposition in London in June, 1904, is described and results of tests made in France and Belgium are reported. It is believed that this churn will prove of practical value.

The perpetuation of pure cultures for butter starters, E. F. PERNOT (*Oregon Sta. Bul. 83, pp. 8, fig. 1*).—Twelve or more pint milk bottles are thoroughly cleansed, half filled with fresh skim milk, and plugged with cotton. Through the plug in one of the bottles a pipette is inserted, a little cotton placed within the glass tube, and a rubber bulb fitted to the upper end of the pipette.

The bottles are then sterilized and the one fitted with the pipette is inoculated with the commercial culture. In perpetuating this culture the plug is removed from another bottle and the plug with the pipette inserted. Pressure on the bulb forces the material contained in the tip of the pipette into the milk and thus inoculates the second bottle. Suggestions are made concerning the prevention of contaminations.

This method of preparing starters was used in the short dairy course by the students with good success. Scores of the butter made in the work are included in this bulletin.

The proteids of cream, butter, and buttermilk in relation to mottled butter, L. L. VAN SLYKE and E. B. HART (*Jour. Amer. Chem. Soc., 27 (1905), No. 6 pp. 679–690, pl. 1*).—This is a reprint in an abridged form of Bulletin 263 of the New, York State Station (E. S. R., 16, p. 1125).

The Camembert type of soft cheese in the United States, H. W. CONN, C. THOM, ET AL. (*Connecticut Storrs Sta. Bul. 35, pp. 32, figs. 3; U. S. Dept. Agr., Bur. Anim. Indus. Bul. 71, pp. 29, pls. 2*).—This is a preliminary report upon cooperative investigations which are being conducted by the Connecticut Storrs Station and the Dairy Division of the Bureau of Animal Industry of this Department.

Soft and hard cheeses are compared, the market for soft cheeses in the United States is discussed, available literature relating to Camembert cheese is briefly reviewed, and the results of the mycological, bacteriological, and chemical investigations to determine the causes of ripening of Camembert cheese are summarized. A description of practical methods is to be published in a later bulletin. The detailed accounts of the three lines of investigation will also follow in separate papers.

The first change affecting the ripening of Camembert cheese is the souring of the rennet curd, which begins while the curd is allowed to stand in the forms for draining. After about 2 days the curd has become hard and sour and is removed to the ripening cellar where, after a few days, molds begin to grow upon the surface. The acidity of the cheese becomes noticeably less in about 2 weeks and later disappears.

As the ripening progresses the cheese becomes soft and yielding to pressure. In half-ripened cheese the outer layer is soft and the central mass hard. In completely ripened cheese the consistency is that of moderately soft butter. In over-ripened cheese the interior becomes liquefied. The characteristic flavor is developed during ripening, but this sometimes does not appear until late in the process. The final product is a cheese having a firm moldy rind and contents uniformly soft to the center and possessing a characteristic piquant flavor.

In brief the results of the investigations indicate (1) that the acidity of the curd is developed by the lactic-acid bacteria commonly used in the form of a starter and that this prevents further bacterial action, (2) that a species of Penicillium (*P. candidum?*) produces the principal changes in the curd and that *Oïdium lactis* in conjunction with the Penicillium produces the flavor, and (3) that no other organisms than these specific molds and bacteria are absolutely necessary for the production of typical Camembert cheese, though other species of bacteria are always present.

Using pure cultures of the organisms mentioned, soft cheeses have been made at the station which, it is stated, have been pronounced by the investigators, importers, and connoisseurs as practically identical with the best imported goods. The

manufacture of first-class Camembert cheese is, therefore, believed to be perfectly practicable under American conditions. It is also believed to be possible to control the ripening to such an extent as to produce a more uniform product.

Cheese ripening materials, F. REISS (*Milchw. Zentbl., 1 (1905), No. 5, pp. 203–208*).—Analyses of 3 proprietary preparations for hastening the ripening of cheese showed the presence of large quantities of sodium bicarbonate, 2 powders containing, respectively, 48.72 and 57.70 per cent, and 1 liquid 8.40 per cent.

Practical tests were made with each of the 3 preparations, the results seeming to be somewhat favorable to the application of an alkali as a means of hastening the ripening of the sour-milk cheese made. The author believes that the use of such preparations should be tested with various kinds of cheese.

Standards for grading cheese and creamery butter, J. A. RUDDICK (*Canada Dept. Agr., Dairy Div.* [*Circ.*], *May 19, 1905, pp. 3*).—Standards with explanatory notes for use in connection with giving certificates as to the quality of cheese and creamery butter are given.

Fifteenth annual meeting of Missouri State Dairy Association, 1905 (*Mo. Bd. Agr. Mo. Bul., 4 (1905), No. 10, pp. 86*).—This contains the president's address and the following papers: The Business Cow for the Business Dairyman, by R. M. Washburn; The Farmer's Dairy Cow, by A. J. Glover; My Experience with Cows, by T. L. Haecker; and Necessary Conditions for Successful Dairying, by H. B. Gurler.

Dairying as a profession, G. L. MCKAY (*Iowa Agr., 5 (1905), No. 12, pp. 414, 415, fig. 1*).—Brief notes are given on the opportunities in this profession.

VETERINARY MEDICINE.

Proceedings of the American Veterinary Medical Association (*Hartford Press, 1904, pp. 414, pls. 9, figs. 7*).—This volume contains an account of the forty-first annual convention of the American Veterinary Medical Association held in St. Louis, August 16–19, 1904. The papers which were read at this convention have been previously noted (E. S. R., 16, pp. 121–128). The following notes are given on papers which were presented by title, but are included in the proceedings:

The source of mucin in the urine of the horse, H. J. Milks (pp. 305–315).—The study of the origin of mucin is presented in considerable detail. It is concluded that the mucin in horse urine comes chiefly from the mucous glands situated in the pelvis of the kidneys. A small amount may come from the glands in the upper part of the ureters, while none has its origin in the bladder.

The relation of bovine and human tuberculosis, E. Perroncito (pp. 319–327).—Some of the recent literature relating to this subject is briefly reviewed by the author and notes are given on experiments in the transmission of bovine tuberculosis to pigs through the alimentary tract. The disease thus artificially produced differs in several particulars from ordinary spontaneous cases of tuberculosis in pigs. The same author transmitted a paper on The Phosphorescence of Meats (pp. 374–378). In this paper notes are given on the phenomena observed in phosphorescent meat. In certain samples of phosphorescent meat the color was dark red and the surface was covered with a mucous exudation. The literature relating to this subject is briefly reviewed.

Inspection and animal quarantines, J. A. Couture (pp. 349–356).—A historical statement is presented of quarantine regulations which have been established in the United States and Canada. Notes are also given on outbreaks of foot-and-mouth disease and contagious pleuro-pneumonia, in connection with which data are presented on the numbers of different kinds of domesticated animals imported to the United States and Canada.

The volume also contains lists of officers, committees, resident State secretaries, honorary and active members, and also the minutes of the business sessions.

Symptomatology and diagnosis of animal diseases, C. CADÉAC (*Sémiologie et diagnostic des maladies des animaux domestiques. Paris: J. B. Baillière & Sons, 1905, vol. 1, pp. 450, figs. 57; vol. 2, pp. 532, figs. 129*).—These volumes treat in considerable detail of the symptoms and methods of diagnosing various kinds of diseases which affect domesticated animals.

The material discussed in the 2 volumes is arranged according to the parts of the body affected and includes diseases of the digestive organs, respiratory apparatus, circulation, urinogenital organs, nervous system, special senses, and locomotor organs. Special chapters are devoted to a general consideration of animal diseases and means of combating them.

Trypanosomes and trypanosomiases, A. LAVERAN and F. MESNIL (*Trypanosomes et trypanosomiases. Paris: Masson & Co., 1904, pp. XI+418, pl. 1, figs. 61*).—In this volume the authors have brought together a summary of accounts of their own and other authors' investigations regarding the morphology and biology of trypanosomes and the symptoms, distribution, and treatment of diseases caused by these organisms.

In a discussion of these problems numerous references are made to the literature of the subject. The volume contains chapters on the distribution of trypanosomiases, technique for the study of trypanosomes, the morphology of various species of trypanosomes, nagana, surra, mal de caderas, dourine, galziekte, trypanosomiases of man, birds, reptiles, amphibia, and fish. An account is also presented of the tsetse flies, with an analytical table for determining these species.

Diseases due to trypanosomes, L. PANISSET (*Rev. Gén. Méd. Vét., 4 (1904), No. 47, pp. 585–604, figs. 8*).—The general distribution of trypanosomiases is discussed, with notes on the species of animals affected and an outline of the symptoms as observed in different diseases of this group. Particular attention is given to surra, nagana, and dourine. These diseases are believed to be transmitted by various biting insects, such as tsetse fly, species of Tabanus, Stomoxys, Hippobosca, etc.

The cultivation of trypanosomata, R. D. SMEDLEY (*Jour. Hyg. [Cambridge], 5 (1905), No. 1, pp. 24–47, pls. 2*).—A table is given showing the various species of trypanosomata thus far discovered, the names of the discoverers, the host affected, and the common names of the disease.

Particular attention is given by the author to the cultivation of *Trypanosoma lewisi*, and *T. brucei*. The former was cultivated for 9 generations during a period of 9 months without apparent change, while the latter was cultivated through 3 generations for a period slightly exceeding 80 days. From a study of well-stained preparations of the rat trypanosomata it was found that the cultural forms differ considerably from those of the adult parasite found in the blood.

Hemorrhagic septicemiæ of domesticated animals, J. TAUFER (*Fortschr. Vet. Hyg., 2 (1904), Nos. 7, pp. 188–204; 8, pp 209–220; 9, pp. 240–251, figs. 3*).—The author presents a general system of classification for diseases caused by ovoid bacteria and belonging to the group of pasteurelloses. This group of diseases affects fowls, rabbits, dogs, cats, hogs, sheep, goats, cattle, horses, and buffalo.

The more important diseases of this group are hemorrhagic septicemia of cattle, fowl cholera, buffalo plague, swine plague, and hog cholera. These diseases may occur in various forms but possess certain striking features of resemblance. As a result of the author's observations of various forms of septicemia and experiments with the organisms which cause these diseases it was concluded that hemorrhagic septicemia of cattle sometimes occurs in an epizootic form in Germany and is due to an ovoid bacterium.

The organism of this disease must be classified with the group of pasteurella according to its morphological and biological characters. The pasteurella of the disease resembles in its virulence that of hog cholera and fowl cholera. All of these organisms are believed to be closely related. The organism of hemorrhagic septicemia of

cattle in the author's experiments produced no toxins in nutrient media. It was found to be pathogenic for all domesticated mammals. The organism apparently was unable to pass through the uninjured mucous membrane of the alimentary tract of rabbits. Animals which possess an active immunity toward fowl cholera are also immune toward hemorrhagic septicemia of cattle.

Experiments with Spengler's formalin method for making pure cultures of tubercle bacilli from bacterial mixtures, A. DWORETZKY (*Centbl. Bakt.* [*etc.*], *1. Abt.*, *Orig.*, *37* (*1904*), *No. 4*, *pp. 626-631*).—Spengler proposed a method for isolating tubercle bacilli from bacterial mixtures by the addition of small quantities of formalin, which was supposed to destroy all other organisms except the tubercle bacillus. This method was given a thorough test by the author, but in all cases negative results were obtained. Whenever a sufficient quantity of formalin was used to destroy the other organisms in the mixture the tubercle bacilli were also killed.

Histological diagnosis of experimental tuberculosis in domestic mammals, S. ARLOING and J. PAVIOT (*Jour. Méd. Vét. et Zootech.*, *55* (*1904*), *May*, *pp. 257-274*, *figs. 6*).—The literature relating to this subject is critically reviewed.

The authors studied this problem from various points of view, giving particular attention to the histological lesions. As a result of these studies it is concluded that the duality of human and bovine tuberculosis can not be sustained. The disease appears in various animal species under a typical form so far as the histological lesions are concerned. In general the pulmonary lesions are more characteristic of the disease than those which occur in other parts of the body. Exceptionally, however, the pulmonary lesions may be absent. In such cases it is necessary to examine other viscera before reaching a diagnosis concerning the disease. Human and bovine tuberculosis are considered forms of one and the same disease.

The influence of splenectomy on the course of infection with tubercle bacilli in homogeneous cultures, F. ARLOING (*Compt. Rend. Soc. Biol.* [*Paris*], *57* (*1904*), *No. 35*, *pp. 524, 525*).—The author studied lesions of tuberculosis produced by intravenous injection of virulent tubercle bacilli with especial reference to the influence of the spleen in this infection.

Small experimental animals were then used in inoculation tests, during which the spleen was removed. It was found that the removal of the spleen favors extension and the rapidity of the development of tuberculous lesions in various organs. When the spleen was removed before inoculation the development of the tubercles was more pronounced than when this operation was performed after inoculation. The facts observed during this study indicate that the spleen plays an important rôle in protecting the organism against infection with tubercle bacilli.

The behavior of native Japanese cattle toward tuberculosis, S. KITASATO (*Ztschr. Hyg. u. Infectionskrank.*, *48* (*1904*), *No. 3*, *pp. 471-484*, *figs. 2*).—It is a well-known fact that native Japanese cattle, under natural conditions, are free from tuberculosis, while cattle imported into Japan appear to be highly susceptible. The author made a number of tests for the purpose of determining whether the native cattle possess any true immunity to tuberculosis.

Extensive statistics are presented regarding the extent of tuberculosis among men in Japan, and the mortality in this disease as compared with the sanitary condition of cattle in different parts of the island. No tuberculosis among native cattle was found even in localities where human tuberculosis prevailed greatly. Experiments were made during which native cattle were inoculated with virulent tubercle bacilli of bovine and human origin. In these experiments, 52 native cattle and 19 cattle of mixed race were used.

It was found as a result of the experiments and observations that human tuberculosis is as prevalent in Japan as in Europe and America. The occurrence of primary intestinal tuberculosis is about the same in adults and children. There are large areas, however, where, in spite of the frequent occurrence of human tuberculosis,

cattle are entirely free from the disease. In such localities neither the milk nor meat of cattle serve as human food. Under natural conditions, therefore, it appears that human tuberculosis is not dangerous for cattle.

The native Japanese cattle appear to be almost entirely insusceptible to tuberculosis. If large doses of pure cultures are inoculated by the intravenous or intraperitoneal methods, native cattle may become infected to a certain extent. They are not susceptible, however, to hypodermic inoculation. It is concluded, therefore, that human tuberculosis is not transmissible to native cattle or cattle of mixed races.

The bacterial flora of softened tubercles in cattle, K. OESTERN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 37 (1904), Nos. 2, pp. 178–185; 3, pp. 334–344; 4, pp. 498–513*).—The literature relating to pyogenic bacteria in cattle is critically reviewed.

Detailed notes are presented on a number of cases of tuberculosis in cattle in which the tubercles were studied with especial reference to the pyogenic bacteria in association with the tubercle bacilli. The pyogenic bacteria were found to be largely staphylococci of a white, yellowish, or orange color. The staphylococci when tested in inoculation experiments on guinea pigs, rabbits, and mice were all found to possess about the same pathogenic properties. When inoculated hypodermically they produced an abscess at the point of inoculation in which staphylococci were found in pure cultures. Later the abscess healed. In white mice, death was produced after 2 or 3 days after hypodermic inoculation.

Numerous inoculation experiments were made with the tubercle bacilli found in softened tubercles. As a result of the author's study it was concluded that virulent tubercle bacilli are regularly present in softened tubercles in cattle. The organisms associated with the tubercle bacilli in such structures are, for the most part, white and yellow staphylococci. The latter organisms in cattle are not to be distinguished either by their morphological or biological characters from staphylococci in man.

Tuberculosis of the upper jawbone in cattle, LIÉNAUX (*Ann. Méd. Vét., 54 (1905), No. 1, pp. 1–7*).—Brief notes are given on the appearance of tuberculosis in the bones, especially in the superior maxillary bone. A description is given for the purpose of differentiating between tuberculosis and actinomycosis of this bone, with detailed notes on a case which came under the author's observation.

Tuberculosis among veal calves, E. CÉSARI (*Rev. Gén. Méd. Vét., 4 (1904), No. 44, pp. 393–402*).—Tables are presented showing the number of calves slaughtered in France from 1899 to 1903, and the number found to be tuberculous during this period. Statistical data are also presented regarding the relative frequency of tuberculosis in different organs and parts of the body. In 12 cases the author determined the presence of tuberculous lesions in the intestinal mucous membranes. A general discussion is given of the significance of lesions in the mesenteric ganglia, peritoneum, liver, spleen, lungs, pleura, heart, and bones.

Tuberculosis of cold-blooded animals, E. KÜSTER (*München. Med. Wchnschr., 52 (1905), No. 2, pp. 57–59*).—The study of tuberculosis among cold-blooded animals is important, not only on account of the desirability of determining the relationship between tubercle bacilli of different origin, but also from a practical standpoint. The practical value of the knowledge of tuberculosis in cold-blooded animals is apparent from the fact that tubercle bacilli from such sources may be used for conferring immunity in domestic animals.

During the author's study of frogs, it was found that 1½ per cent of these animals are affected with tuberculosis. The most conspicuous alterations due to the disease are observed in the liver. Numerous inoculation experiments were carried out with pure cultures of bacilli obtained from frogs. During these experiments frogs, salamanders, lizards, crayfish, turtles, snakes, carp, and barbel, as well as guinea pigs, rabbits, rats, and mice, were inoculated.

It was found that all cold-blooded animals were susceptible to the action of these bacilli. Some of the warm-blooded experimental animals were killed by inoculation

without, however, showing a typical bacterial infection. Frogs, lizards, and turtles were most susceptible to the disease. When rabbits are inoculated with tubercle bacilli obtained from frogs, small tubercles develop in the body cavity within a period of 6 weeks, and these structures closely resemble those of tuberculosis.

The resistance to bovine tubercle bacilli of two cattle in Marburg which had been treated with tubercle bacilli of different origin, A. EBER (*Berlin. Tierärztl. Wchnschr., 1904, No. 53, pp. 888-891*).—A historical statement is made regarding 2 young cattle which were immunized against bovine tuberculosis. One of the animals was previously treated with intravenous injections of bovine tubercle bacilli which had been attenuated by the addition of iodin trichlorid. The other animal had received intravenous injections of greatly attenuated human tubercle bacilli.

It was found during the experiments which were made on these animals that the intravenous injection of 0.05 gm. of moderately virulent tuberculous virus of bovine origin caused a temporary loss of weight, slight fever after 40 days, a cough, and tuberculin reaction. Subcutaneous injection of 0.5 gm. of similar material in nonimmunized cattle caused the appearance of tuberculous infiltration at the point of inoculation. The 2 immunized cattle, however, withstood subcutaneous injection without any reaction.

Subcutaneous injection of 1 gm. of moderately virulent tuberculous virus of bovine origin caused a large tuberculous infiltration at the point of inoculation, swelling of the corresponding lymph glands, and an elevation of temperature. Experiments were also carried out during which 2 gm of the material were used in inoculating immunized and nonimmunized animals. From this set of experiments it appears that animals which have been treated by the von Behring method are more resistant to artificial infection than untreated animals The resistance is not absolute.

It was found in these experiments that the tuberculin test in case of animals immunized against tuberculosis is not a reliable criterion for determining the presence of tuberculous lesions. The author believes, however, that it is possible to produce considerable resisting power toward tuberculosis by previous treatment with attenuated tubercle bacilli of bovine or human origin.

Antituberculous vaccination according to von Behring, J. B. SCHOFFIÉ (*Rev. Gén. Méd. Vét., 4 (1904), No. 48, pp. 649-655*).—Brief notes are given on the results of experiments by different authors with von Behring's method of vaccination against tuberculosis.

From this discussion and from the author's experiments, it is concluded that young cattle may be successfully vaccinated against tuberculosis by different methods, particularly by the use of intravenous injections of human tubercle bacilli. The practical value of this method can not be established upon a firm basis until results of experiments now in progress in different countries are known. Von Behring's method is considered to be harmless for young animals, but various suggestions are made regarding the improvement of the method.

The transmission of animal tuberculosis to man by means of milk and prophylactic measures, VALLÉE and VILLEJEAN (*Rev. Gén. Méd. Vét., 4 (1904), No. 46, pp. 521-535*).—The authors believe that it has been definitely established that the milk of tuberculous cattle is a dangerous food for man. It remains, therefore, to determine the extent of danger from the ingestion of milk which contains tubercle bacilli.

From the authors' experiments along this line it appears that while bovine tuberculosis is transmissible to man, and the milk of all tuberculous cattle may be virulent, that which comes from cases of mammary tuberculosis is especially so. The only satisfactory method of preventing such transmission through the milk is found in the compulsory pasteurization, boiling, or sterilizing all milk from herds of cattle where tuberculosis has been detected and where the tuberculin test has been given.

The relation between human and animal tuberculosis, DAMMANN (*Deut. Tierärztl. Wchnschr., 12 (1904), No. 53, pp. 541–545*).—Attention is called to the results recently announced by the German Imperial Commission on the investigation of tuberculosis.

The author has been carrying on experiments along this line for a number of years and has found that there are races of human tubercle bacilli which are capable of producing general and fatal tuberculosis in calves and hogs within a comparatively short time. Detailed notes are given on the number of inoculation experiments with such material and on the post-mortem examination of the experimental animals. Material was obtained from a human case of peritoneal tuberculosis, and when inoculated subcutaneously into hogs produced striking cases of pulmonary tuberculosis. The experimental animals died within from 28 to 42 days.

Combating bovine tuberculosis on the basis of the unity of this disease, MOREY (*Rev. Gén. Méd. Vét., 3 (1904), No. 35, pp. 577–592*).—An obligatory system of prevention is recommended, based on the application of the tuberculin test to all cattle in affected herds. The value of the tuberculin test is discussed in connection with a general argument of the necessity of controlling tuberculosis, both from a standpoint of animal production and human health.

Heart water in cattle, F. A. VERNEY (*Natal Agr. Jour. and Min. Rec., 7 (1904), No. 11, pp. 1009–1013, pl. 1*).—Several outbreaks of this disease were observed by the author. The blood from diseased animals when inoculated into healthy animals produces symptoms of the disease after an incubation period of from 5 to 15 days. The micro-organism, which is the cause of this disease, has not been isolated, but experiments have shown that it must be transmitted by the bont tick (*Amblyomma hebræum*).

Rinderpest and the action of Koch's method of bile inoculation, HAEDICKE (*Berlin. Tierärztl. Wchnschr., 1904, No. 50, pp. 823–828*).—A brief historic statement is made concerning the distribution of rinderpest and the losses caused by this disease. Notes are also given on the symptoms and pathology of rinderpest.

The author carried on a number of experiments according to the method of vaccination by means of bile. It is concluded as a result of these studies and observations that rinderpest is enzootic in China, Korea, and Japan. The disease is transmitted by contact. In regions affected with rinderpest, morning temperatures of 38.9° C. or higher, as well as temperatures under 37.1° C., are to be considered as suspicious.

A passive immunity is produced by the use of 10 cc. of bile by the hypodermic method. Such a vaccination influences the course of subsequent infection so that in 66 per cent of the cases the acute form of the disease does not appear, while in the remaining 24 per cent the course of the disease is shortened and much modified. The mortality after such treatment was about 10 per cent.

The immunizing action of the bile of cattle affected with rinderpest, C. ADANI (*Clin. Vet. [Milan], 27 (1904), No. 48, pp. 285–290*).—In order to bring about immunity by the use of bile it is recommended that subcutaneous injections be administered in doses of 10 cc. For this purpose the bile should be collected under antiseptic conditions.

Not all qualities of bile are adapted for use in producing immunity. No blood should be mixed with the bile, since in such cases the active principle of the bile seems to be destroyed. Bile may be desiccated and may thus continue to show an immunizing property for 50 to 80 days. When bile from cattle affected with rinderpest is heated to a temperature of 60° C. it loses its immunizing property entirely.

The Molteno cattle disease, W. H. CHASE (*Agr. Jour. Cape Good Hope, 25 (1904), No. 6, pp. 675–678*).—The symptoms of this disease are briefly described.

As a rule, affected animals are noticed to be sick only 3 or 4 days before death. When examined post-mortem, animals show a pronounced chronic cirrhosis of the liver and this is the most conspicuous lesion of the disease. Inoculation experiments

were tried during which it was shown that the blood and stomach contents of diseased animals were not pathogenic for healthy cattle.

Feeding experiments with *Senecio burchellii* demonstrated that this plant is capable of producing pronounced diarrhea together with the characteristic cirrhosis of the liver. The disease in question, therefore, closely resembles the disease produced in New Zealand and Canada by eating *S. jacobœa.*

The use of serum in the practical treatment of anthrax, A. Carini (*Schweiz. Arch. Tierheilk, 46 (1904), No. 6, pp. 296–304*).—Detailed notes are given on 9 cases in which antianthrax serum was used.

As a result of the author's experience it is concluded that serum therapy may be successfully used in veterinary practice and should be the first choice as a treatment in incipient cases. It may be used in large and repeated doses (150–200 cc. in all). Ten cubic centimeters of the serum is not sufficient to produce a certain immunity in cattle against anthrax. It is better to employ at least as much as 20 cc.

The immunization of sheep for tho purpose of obtaining a polyvalent serum against anthrax and blackleg, V. Galtier (*Jour. Méd. Vét. et Zootech., 55 (1904), Dec., pp. 705–710*).—In the author's experiments, 2 sheep were hyperimmunized by means of repeated inoculations of anthrax and blackleg cultures.

The first inoculations were with anthrax cultures attenuated by means of Lugol's solution. Later, more virulent cultures were given in increasing doses, followed by blackleg cultures and lastly with mixtures of anthrax and blackleg cultures. In all 26 inoculations were given. It was found that the sheep after having received these inoculations at intervals of from 2 to 3 weeks were still in good health.

The serum obtained from these animals was found to be polyvalent. When injected into rabbits and guinea pigs it protected them against an anthrax inoculation 24 hours later and against blackleg inoculation made after a lapse of a similar period.

Disinfection of animals in preventing foot-and-mouth disease, Blume (*Berlin. Tierärztl. Wchnschr., 1904, No. 52, pp. 874, 875*).—The author has found that the hair and skin of living animals may be thoroughly disinfected by the application of a solution of lysoform soap. This material has no injurious effect upon the animal and is, therefore, to be preferred to corrosive sublimate and similar drugs. The hoofs of animals which have been exposed to infection required more thorough treatment than the general integument.

A process of disinfection in the prevention of foot-and-mouth disease should be applied to animals which are affected with the disease, animals which have been directly exposed in stalls or pastures, animals which come from localities in which the disease prevails, and animals which have recently been transported in cars or ships where infection may have existed.

The treatment of milk fever with air and iodid of potash, F. thor Straten (*Maanedskr. Dyrlæger, 16 (1904), No. 6, pp. 165–167*).—During the past 2½ years the author has treated 96 cases of milk fever, of which 72 received iodid of potash, while 24 were treated with air. Of the cases treated with iodid of potash, 6 died, while among the 24 treated with air only 1 case resulted fatally and that was due to improper care.

Necrotic stomatitis, with special reference to its occurrence in calves (calf diphtheria) and pigs (sore mouth), J. R. Mohler and G. B. Morse (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 67, pp. 48, pls. 5*).—In this country the disease affects calves and young pigs. In calves it has been known as calf diphtheria, but this is a misnomer.

The literature of the subject is discussed in connection with a bibliography, and notes on the distribution, etiology, and pathological anatomy of the disease. Necrotic stomatitis is due to *Bacillus necrophorus* and is an acute contagious inflammation of the mouth characterized by ulcers and necrotic patches. The disease occurs most

frequently in connection with the eruption of the first teeth. The course of the disease is from 5 days to 5 weeks, and untreated animals die in a large percentage of cases.

In treating the disease all affected animals should be isolated, the mouths of exposed calves and pigs should be washed with an antiseptic, and stalls and premises should be disinfected. The mouth and other affected surfaces should be carefully cleansed and disinfected twice daily with a 2 per cent solution of creolin in warm water. Good results may be obtained also from the use of a 1 per cent solution of carbolic acid. Lugol's solution and potassium permanganate also act in an efficient manner.

Bacillus necrophorus has a wide distribution in nature and causes a great variety of lesions in different animals.

Sheep parasite in Australia, F. W. Goding (*Mo. Consular Rpts.* [*U. S.*], *No. 290, pp. 93, 94*).—The sheep maggot fly has gradually been becoming a most serious pest in Australia for the past 10 years. It attacks chiefly breeding ewes and lambs. In destroying these pests most ranchmen use a lime and sulphur dip. Attention has been called to the fact that in Scotland carbolic washes for this purpose have been discarded. Sulphur and oil has been used more extensively, arsenic being added in cases where there are no skin lesions.

The etiology of hog cholera, M. Dorset, B. M. Bolton, and C. N. McBryde (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 72, pp. 101, pls. 3*).—The Bureau of Animal Industry of this Department has, for many years, been investigating the infectious diseases of swine and methods of producing immunity against these diseases.

The discovery of the hog cholera bacillus in 1885 was considered as a great step in advance in the investigation of hog cholera. The bacillus was at first thought to be the bacterial cause of hog cholera. Recent experiments, however, summarized in the bulletin under discussion indicate that while the hog cholera bacillus is a pathogenic organism capable of causing death in hogs when inoculated intravenously and generally fatal when taken into the alimentary tract, it is nevertheless not the prime cause of the disease. *Bacillus choleræ suis* is found in most cases of spontaneous hog cholera and is very fatal to rabbits and guinea pigs by intravenous or subcutaneous inoculation.

A preliminary announcement of the discovery of the infectiousness of blood serum free from hog cholera bacillus but obtained from an animal suffering from the disease was made in 1903, and the announcement was supplemented by another circular issued by the Bureau of Animal Industry in 1904. The results of the experiments carried out by the authors and Doctor de Schweinitz show that pure cultures of hog cholera bacillus when injected into hogs subcutaneously produce as a rule only slight disturbances. The lesions thus caused may resemble those seen in acute cases of hog cholera, but the disease does not produce the general characteristics of contagiousness.

The most striking facts in connection with these experiments, however, is that hogs which recover from such infection are not immune when subsequently exposed to natural infection. The experiments have shown conclusively that blood serum from hogs affected with hog cholera and known to be free from *Bacillus choleræ suis* produces disease in hogs regularly after subcutaneous injection, and also "that the disease thus produced possesses all of the characteristics of the natural disease, including symptoms, lesions, contagiousness, infectiousness of the blood, and immunity in those animals which recover."

All attempts to isolate the micro-organisms from the filtrates with which the authors experimented were without result. The pathogenic property of the filtered blood, however, is certainly due to the presence of a micro-organism since the disease is produced by the filtered serum and may be transferred to other animals by subcutaneous injections. The hog cholera bacillus was also present almost uniformly in all

cases of the disease studied by the authors. The exact rôle played by this organism, however, is not definitely known.

It appears to be necessary to assume that hogs are subject to a disease caused by the hog cholera bacillus and having no connection with that produced by the filterable virus found in the outbreaks of the hog disease under discussion. Whatever may be the influences which lead to an invasion of healthy hogs by the hog cholera bacillus the authors believe that the filterable virus investigated by them is the direct cause of the high degree of infectiousness characteristic of the disease which was studied.

The virulence of cultures of bacilli of swine erysipelas after the addition of serum or grape sugar, P. Gordan (*Berlin. Tierärztl. Wchnschr., 1904, No. 53, pp. 891, 892*).—A considerable series of culture experiments along this line were carried out by the author. It was not possible to immunize mice against swine erysipelas by inoculation with erysipelas bacilli to which grape sugar had been added. By the addition of 0.1 per cent sheep-blood serum to the nutrient bouillon it was possible to increase the reproductive power of the bacilli. It was noticed that even after 6 weeks such cultures had not lost their virulence as they usually do in ordinary media.

Combating fowl cholera and swine plague, Klett and Braun (*Deut. Tierärztl. Wchnschr., 12 (1904), Nos. 51, pp. 517–521; 52, pp. 529–532; 53, pp. 545–547*).—In the opinion of the authors the toxins in filtrates and the endotoxins of *Bacillus avisepticus* and *B. suisepticus* are identical. The former produces more toxin than the latter. The toxicity of the toxins from both organisms appears to be independent of the virulence.

For the purpose of producing a preventive serum against swine plague, horses were treated, for long periods, with dead cultures and with filtrates. The serum thus obtained was both bactericidal and antitoxic. The passive immunity produced by treatment of gray mice with this serum lasted for 3 or 4 weeks. It was not determined whether an active immunity could be brought about by this serum. Brief notes are also given on hog cholera.

Bacterial pyelonephritis in hogs, E. Wyssmann (*Schweiz. Arch. Tierheilk., 46 (1904), No. 6, pp. 287–290*).—The symptoms and etiology of this disease are briefly discussed. In some cases studied by the author it is believed that the disease was due to a mixed infection which occurred at the time of birth. The lesions caused during the development of this disease are briefly described.

The external parasites of hogs, E. C. Stevenson (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 69, pp. 44, figs. 29*).—The most important external parasites of the hog are *Hæmatopinus suis*, *Sarcoptes scabiei suis*, and the mite which causes follicular mange. The last named parasite, however, seemed to be of little economic importance.

A historic review is given of the appearance, synonymy, and classification of *H. suis*. This parasite lives on domesticated and wild hogs, but is not known to live as a parasite on any other animal. The insect is described in detail in all of its stages. The eggs are deposited largely on the hair back of the ears and along the shoulders and flanks. The period of incubation appears to be 15 or 16 days at a temperature of 85° F. The parasites cause an irritation of the skin with the formation of scales and inflammation. Certain authors believe that hog lice may carry the infection of hog cholera.

In combating this pest the pens of infested hogs should be thoroughly treated. If they are kept vacant for 2 weeks or more the lice seem to perish. Various remedies have been suggested for the treatment of infested buildings, but whitewash made in the proportion of 1½ lbs. of lime to 1 gal. of water is probably the most convenient method. Experiments with remedies applied directly to hogs, such as kerosene emulsion, kerosene and water, pure kerosene, and benzine emulsion are successful,

cheap, easily prepared, and readily applied. Directions are given for the preparation of the more important of these remedies.

Sarcoptic mange of hogs is described with notes on the symptoms and methods of contagion. In severe cases it ultimately causes the death of young pigs. Dipping combined with scrubbing is the only practical method of eradicating this disease. A second dipping should follow 6 days after the first treatment. Notes are also given on infestation with *Demodex phylloides*, and detailed directions are presented for the preparation of suitable vats and other apparatus to be used in dipping hogs. A bibliography of the subject is appended to the bulletin.

An infectious disease of horses with alterations in the bones, CHARON and THIROUX (*Rec. Méd. Vét., 81 (1904), No. 23, pp. 737–759, figs. 2*).—In Madagascar a certain percentage of horses and mules are affected with a specific disease accompanied with changes in the bone tissue. The symptoms include general debility, uncertain gait, redness of the conjunctiva, occasional hemoglobinuria, etc. Detailed notes are given on the bone affections which accompany the disease. In blood preparations the author found specimens of *Piroplasma equi*. Detailed notes are given on a number of cases of this disease.

Immunization against horse sickness by the method recommended by Professor Koch, C. E. GRAY (*Jour. Compar. Path. and Ther., 17 (1904), No. 4, pp. 344–351*).—A number of experiments in the treatment of this disease were begun by Koch during his sojourn in Bulawayo. These experiments were continued by the author and his associates.

It has been found that unless the process of repeated inoculation is extended over a very long period and unless the doses of virulent blood are increased more gradually than recommended by Koch a point is reached at which the natural resistance of the animal is overcome and an attack of horse sickness occurs.

Apparently no real or lasting immunity is established even after the animal has withstood inoculation with a dose of 5 cc. of virus. Among the 20 horses, the treatment of which was begun by Koch and finished by the veterinary service of Rhodesia, 12 subsequently reacted and died of horse sickness.

Fowl plague, G. MARCONE (*Rev. Gén. Méd. Vét., 3 (1904), Nos. 32, pp. 409–423; 33, pp. 465–481*).—Attention is called to the fact that this disease affects not only the ordinary domestic fowls, but pheasants and a number of wild birds.

Notes are given on outbreaks of the disease. The various forms under which it occurs are described and a brief account is presented of its pathological anatomy. Various micro-organisms have been suspected of causing this disease, but thus far no investigator has been able to demonstrate to a certainty the pathogenic organism. The virus maintains its virulence under ordinary conditions for from 21 to 90 days, depending on the temperature. Chickens are most susceptible, but ducks, geese, and other domestic birds may also be affected. Particular attention is given to a study of this disease among pheasants.

Fowl plague has been particularly destructive to pheasants in the neighborhood of Naples. The spread of the disease among pheasants in parks is believed not to be due to wild birds, but to stray domestic fowls.

Vaccination against fowl cholera by means of toxins, C. BISANTI (*Rev. Gén. Méd. Vét., 4 (1904), No. 45, pp. 457–460*).—According to the author's experiments it is possible to produce immunity against fowl cholera in susceptible animals by means of cultures in vivo in collodion sacs. The presence of cultures in the peritoneum, as interchanges between them and the living organism are very active, confers more lasting immunity than can be obtained by hypodermic vaccination.

Serum inoculation for fowl cholera, T. KITT (*Monatsh. Prakt. Tierheilk., 16 (1904), No. 1, pp. 1–19*).—It was found possible by repeated subcutaneous inoculations with cultures of *Bacillus avisepticus* in horses to obtain a serum which, in doses

of 2 to 5 cc., would protect rabbits, geese, ducks, chickens, and even pigeons against large subcutaneous injections with virulent blood.

These experiments were repeated on a number of horses, and in some cases it was found possible to obtain an exceedingly active serum within a very short time. In all these experiments the control animals died within 12 to 48 hours, while the treated animals were unaffected by virulent cultures. This treatment is considered, therefore, as conferring a passive immunity. The duration of such immunity appears to be about 18 days. Experiments with female hares showed that the immunity produced in this manner may be transmitted from the mother to the offspring.

RURAL ENGINEERING.

Irrigation in Canada (*Jour. Soc. Arts, 53 (1905), No. 2740, pp. 745-747*).—A description of irrigation works and the possibilities of irrigation in the semi-arid region of the South Saskatchewan Valley, 10,000,000 acres of which are estimated to be irrigable. The international complications between the United States and Canada regarding the water supply for irrigation on the two sides of the boundary line are briefly referred to.

Irrigation in the United States, ZIMMERMANN (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 22, pp. 145-150*).—A brief account showing the extent and development of irrigation in this country, and referring to the work of this Department in aid of irrigation.

The irrigation project of the Canadian Pacific Railway (*Engin. News, 53 (1905), No. 17, pp. 429-431, figs. 8*).—A system of canals taking water from Bow River to ultimately irrigate over 1,000,000 acres of land near Calgary is described.

Irrigation in Klamath County, F. L. KENT (*Oregon Sta. Bul. 86, pp. 16, figs. 3*).—This is an account of experiments made in cooperation with this Office to determine losses by seepage and evaporation, the duty of water under different conditions, and the cost of applying water in irrigation. The results and conclusions reached are summarized as follows:

"(1) In the soils of the region considered the losses by seepage and evaporation are comparatively small, ranging between 10.24 per cent and 13.5 per cent in the three cases observed on main ditches.

"(2) The percentage losses in laterals may be considerably greater than in the main ditches.

"(3) The duty of water was rather high, a depth of only 4.92 to 6.27 in. being required to produce the desired moisture conditions for the second irrigation of alfalfa fields.

"(4) The cost of applying water to checked fields, after the land is properly fitted, is less than one-half the cost of application in free flooding.

"(5) During the height of the growing season the evaporation from a water surface may amount to a depth of 11 in. in 31 days.

"(6) Chemical analyses show the waters of this region to be very desirable for irrigation purposes.

"(7) While two irrigations are commonly given alfalfa fields each season, there is a growing tendency toward the use of three."

Water problems of Santa Barbara, California, J. B. LIPPINCOTT (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 116, pp. 99, pls. 8, figs. 17*).—This bulletin describes the location and drainage of this district, reviews earlier work by others, and summarizes data relating to the sources of water supply of the city and suburbs of Santa Barbara.

The use of irrigation for different crops, E. J. WICKSON (*For California, 2 (1905), No. 8, pp. 5, 6*).—General information applicable especially to California conditions.

Geology and water resources of a portion of east-central Washington, F. C. CALKINS (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 118, pp. 96, pls. 4, figs. 14*).—This paper reports studies of the topography, climate, vegetation, agricultural conditions, geology, and hydrology of an area on the arid Columbia Plains, covering parts of Douglas, Lincoln, Adams, Franklin, Yakima, and Kittitas counties, a large portion of which is said to be almost without surface streams available for the uses of mankind.

"Surface wells capable of supplying perennially even the modest requirements of domestic use can be sunk only in places where conditions are locally favorable. Springs once formed the only source of water for a large area, but they are so widely scattered and often so difficult of access that great labor is sometimes involved in hauling a supply from them. Deep wells, now fairly numerous and rapidly increasing in number, are coming to be considered the most satisfactory sources of water. To determine to what extent the supply from these wells may be increased, and to find whether there is hope of obtaining artesian flows in any portion of the region, were the prime objects of the writer's expedition."

It is stated that abundant water of good quality may be found in the region at depths varying from 40 to 670 feet. Apparently the water is as a rule under pressure and therefore in a broad sense artesian. The success of deep borings for artesian water is questioned.

A general working plan for the irrigation farm of Berlin, A. BACKHAUS (*Allgemeiner Wirtschaftsplan für die Rieselgüter der Stadt Berlin. Berlin: W. & S. Loewenthal, 1905, pp. 80*).—This report discusses the scope and purpose of the Berlin sewage irrigation farm, its organization, operations, equipment, results, etc.

Agricultural experiments on the irrigation farm of Berlin during 1904, A. BACKHAUS (*Landwirtschaftliche Versuche auf den Rieselgütern der Stadt Berlin in Jahre 1904. Berlin: Paul Parey, 1905, pp. 122, figs. 11*).—Plat experiments with a great variety of garden and field crops and forage plants are reported. Pot experiments with sewage sludge and sludge ash and experiments in composting sludge are also reported.

The experiments include tests of varieties, amounts and methods of application of the sewage, fertilizers, methods of soil preparation and culture, tests of special forms of cultural implements (plows, mowing machines, etc.), methods of curing crops, control of weeds and plant diseases, etc., as well as studies of soils and drainage waters.

The experiments were seriously interfered with by drought, but the results obtained indicate a number of ways in which improvements may be made, among which are (1) occasional liming to improve the physical condition of the soil; (2) so arranging the irrigation as to protect against drought; (3) shallow culture in spring and deep culture in summer and fall; (4) avoiding excessive accumulations of sludge on the soil; and (5) raising fish in the drainage water.

Measuring the flow in underground streams (*Irrig. Age, 20 (1905), No. 8, p. 233, figs. 2*).—A brief description of Slichter's method.

River surveys and profiles made during 1903, W. C. HALL and J. C. HOYT (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 115, pp. 115, pls. 4, figs. 18*).—This paper contains the results of cooperative river surveys carried on during 1903 between the topographic and hydrographic branches of the Geological Survey. It presents data of special interest to engineers and others interested in power development.

Relation of the law to underground waters, D. W. JOHNSON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 122, pp. 55*).—In this paper an attempt is made to outline the main features of the laws respecting underground waters, with the object of giving to the owner of such waters some idea of his rights and obligations concerning them.

"It is needless to say that the report is in no sense a legal treatise, but rather an endeavor to collect and arrange such legal decisions as will serve to show the relation of the law to problems which are essentially geological in character. In summing up the general features of this law, I have recorded some observations which present themselves to the student of geology." The paper is divided into 2 chapters: (1) common law rules concerning underground waters, and (2) legislative acts affecting underground waters.

Bibliograghic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, M. L. FULLER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 120, pp. 128*).

The lignite of North Dakota and its relation to irrigation, F. A. WILDER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 117, pp. 59, pls. 8, figs. 5*).—"The investigation on which this report was based was carried on under the charge of Mr. N. H. Darton as a part of the general investigation of the underground-water resources of the western portion of the United States."

Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, J. C. HOYT and B. D. WOOD (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 119, pp. 253*).

Contributions to the study of drainage, E. RISLER and G. WERY (*Ann. Inst. Nat. Agron., 2. ser., 4 (1905), No. 1, pp. 5–23, dgms. 4*).—The interrelations of precipitation, temperature, evaporation, and drainage are discussed, with detailed data of observations on this subject.

Tile drainage, F. W. TAYLOR (*New Hampshire Sta. Bul. 118, pp. 19–48, figs. 12*).—This bulletin describes the implements and methods used in tile drainage, as well as the classes of lands needing drainage in New Hampshire and the best methods of handling them. A drainage system put in at the New Hampshire Station is described, and a statement of cost is given. "The classes of land in New Hampshire needing drainage are (1) meadow lands, (2) gently rolling tillable lands, (3) lowlands around swamps or lakes, (4) lowlands adjacent to salt water. Thorough drainage on most lands will cost \$35 to \$40 per acre. Many lands can be greatly benefited for \$15 or \$20 per acre."

Notes regarding sewage disposal at Paris and Berlin (*Engin. News, 53 (1905), No. 11, p. 285*).—A brief review is given of the annual reports of the operation of the sewers and sewage disposal systems of Paris and Berlin for the year 1903. It is noted that in neither city at the present time is any untreated sewage discharged into the streams. At Paris the greater part of the irrigated land is under private ownership, taking sewage by agreement, and in general in such quantities as are required by the crops. At Berlin the whole irrigated area is owned by the city. The following comparative data are taken from the reports:

Statistics of sewage disposal in Paris and Berlin.

	Paris.	Berlin.
Population by last census	2,714,068	1,956,010
Drinking water supply, gallons per capita daily	32	21
Unfiltered river water (not used for domestic purposes)	62	....
Total water supply, gallons per capita daily	94	21
Sewage pumped, gallons per capita daily	59	32
Area actually under irrigation, in acres	13,100	17,500
Average quantity of sewage applied, gallons per acre daily	12,300	3,530
Number of persons per acre	207	112

It is stated that of the whole volume of sewage applied to the land at Paris fully one-half reappears in the drains, where it is measured, sampled, and tested regularly as to the degree of purification. It is claimed that these examinations "demonstrate the perfect harmlessness of the waters after their passage through the soil."

The cost of pumping and distributing the sewage, not including interest and sinking fund charges, is $11.30 per million gallons at Paris and about $9 at Berlin. At Berlin the income from the sewage farms exceeds the cost of their operation and has done so for several years past.

Historic highways of America, A. B. HULBERT (*Cleveland, Ohio: Arthur H. Clark Co., 1905, vol. 16, pp. 188*).—An index to volumes 1 to 15.

Data on roads and pavements in Iowa (*Engin. News, 53 (1905), No. 6, pp. 143, 144, figs. 2*).—This article calls attention to a marked revival of paving in Iowa following the enactment of an amended paving law, reports traction tests on brick and asphalt pavements at Iowa State College, and gives a general survey of road conditions in the State. Attention is called especially to the State law creating the Iowa State College a highway commission, and pointing out the fact that although about $2,250,000 of road taxes are annually collected and expended upon the country roads of the State, these roads, like those of the surrounding States, are notoriously bad, especially in bad weather.

Improving the roads (*Country Gent., 70 (1905), No. 2731, pp. 509, 510*).—In this paper, which was read at the good roads conference held at Cornell University, May 17, 1905, it is considered unwise to attempt in general to bring our roads up to the European standard within a few years, or to construct a great State system of macadam or similar roads. The gradual improvement of such roads as we have is advised, reserving in all cases about four-fifths of the available funds for maintenance and repairs.

Miscellaneous implements exhibited at Park Royal, 1904, J. B. DUGDALE (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 184–211, figs. 18*).—This article describes the implements and appliances to which silver medals were given at this exhibition, besides a number of agricultural engines, dairy appliances, swath turners, plows, drills, root cleaners and graters, potato digger, horse hoe, and miscellaneous articles.

Electric plows in Italy, P. CUNEO (*Mo. Consular Rpts. [U. S.], 1905, No. 292, pp. 111, 112; Amer. Agr., 75 (1905), No. 22, pp. 615, 616, fig. 1*).—A device invented and constructed by the Italian Electrotechnical Society of Turin for applying electric power to plows and other farm machinery is described, and an account is given of successful experiments in plowing by means of electric power.

"The [plowing] device consists of two power cars, which are stationed at each side of the field and between which are stretched cables attached to the plow. The electric current is taken from a trolley line; a current of about 500 volts is said to be needed. Each car is said to communicate 25 horsepower, which can safely be increased to 40 horsepower. The plow is pulled by the cables from one side of the field to the other, and when it reaches the end of the furrow it stops automatically, the current being cut off. It can be run backward or forward with ease. One man manages the plow, and each car is operated by one man. Thus three men do all the work.

"Of course, much depends on the condition of the soil, but it is said that from 7 to 15 acres can be plowed in 12 hours. These power cars are said to be as easily managed as traction engines, and their power can be applied to thrashing machines, corn shellers, pumps, grain drills, etc."

The evolution of the plow (*Maschinen Ztg., 3 (1905), No. 1, pp. 2–4, figs. 13*).—A brief account.

Plowing with a traction engine (*Amer. Threshermann, 8 (1905), No. 1, pp. 3–7, figs. 13*).—The cost and efficiency of this method of plowing are discussed.

On peat gas motors, HUBENDICK (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 1, pp. 46–54*).

RURAL ECONOMICS.

The business side of agriculture, A. G. L. ROGERS (*London: Methuen & Co., 1904, pp. 159*).—This book is a study of the economic problems of the English farmer, with especial reference to the methods of marketing farm products.

The introductory chapter deals with the farmer and his markets. The fact is especially emphasized that the English farmer is a business man, that he "seeks to make money exactly as the manufacturer does." The reasons given for the English farmers being so distinctively commercial agriculturists are that (1) they are practically all tenant farmers and invariably pay cash rent, and (2) they depend more largely upon the market for the articles of every-day consumption than do the farmers of most other countries; the bread supply, for example, is bought ready-baked. These demands for money make it necessary for the farmer to center his thought and energy upon the one problem of putting upon the market those products which will best replenish his bank account.

Chapters II and III are devoted to a discussion of the "traditional methods" of marketing the various products of the farm, including cereals, hops, fruits, vegetables, live stock and live-stock products. Special attention is given to the methods of marketing wheat in America and England. The great variety of weights and measures which still remain in use in the rural districts and the different methods of making the sales are described in considerable detail.

To the English farmer the marketing of live stock and dairy products is more important than the marketing of grain. "Barely one-seventh of the supply of wheat consumed by the nation is grown in these islands, while more than one-half of the meat eaten at home is home-bred." There are two methods commonly used in disposing of live stock. The first is by direct sale; the second by auction. Where the first method is used the custom is for the seller to seek his purchasers by advertising widely in the agricultural and other newspapers. The most common method of selling live stock, however, is by auction, and these auctions take place most commonly at the markets. "Nearly every large town has its market, some more than one, while many quite insignificant villages have their sale yards; and other places are known entirely by the great fairs held there once or more often every autumn or spring. There are about nine hundred such places in Great Britain."

The fourth, which is also the last, chapter is devoted to a discussion of "some of the schemes that have been devised in recent years by persons or organizations interested in the prosperity of the agricultural classes to assist them to dispose of their produce to better advantage." The principal organizations described are the following: The National Poultry Organization Society; the Produce Supply Association; the Agricultural Organization Society; the Irish Agricultural Organization Society; the Irish Agricultural Wholesale Society; and the Irish Beekeepers' Federation.

The influence of farm machinery on production and labor, H. W. QUAINTANCE (*Pubs. Amer. Econ. Assoc., 3. ser., 5 (1904), No. 4, pp. 1-106*).—This monograph contains a discussion of the course of agricultural production as contrasted with the increase in population. It discusses the increase in cultivated area per farm worker and the greater effectiveness of farm workers when aided by machinery, the cost of production by hand and by machine methods, the wages of labor under hand and under machine methods, the influence of machinery upon fluctuations in quantity and quality of product, upon the size of farms, the life and general welfare of the farmer, and upon the length of the working day.

Largely owing to the introduction of new forms of machinery, the area of land devoted to the crops in the production of which machinery has come to be generally used has increased from 23.3 acres in 1880 to 31 acres per male worker in 1900. The general conclusion is reached that the introduction of agricultural machinery during

the 20 years from 1880 to 1900 increased the effectiveness of human labor on the farm about one-third. The increase in the use of machinery has reduced the number of laborers per farm, increased the wages of labor, and shortened the length of the working day on the farm.

The decline of landowning farmers in England, H. C. TAYLOR (*Bul. Univ. Wis., 1904, No. 96, pp. 1-66*).—This monograph shows that more than half of the farmers of England of 200 years ago owned the land which they cultivated, but at the present time the representatives of this class are very few, so few indeed that the word "farmer" means "tenant farmer" in England.

The most important causes of decline were: (1) The introduction of new agricultural methods which made large farms more profitable than small ones; (2) the agricultural depressions which forced those who were heavily in debt to sell their land; (3) the very high price of land due to the presence of a wealthy class of merchants and manufacturers who, because of the social position which is usually attached to the ownership of landed estates in England, were often willing to pay twice as much for the land as the farmers could afford to pay; and (4) the law and custom of progeniture and entail.

The first three conditions and forces made it necessary for the farmers to part with their land, and the fourth condition kept the land locked up in large estates after the farmers had parted with it, so that even if the farmers desired to buy land at the high prices they would find few farms for sale. But as a matter of fact the farmers of England rarely think of buying land, because they find the tenant system more profitable. "The relation between landlord and tenant is very satisfactorily arranged. The farmers are as a rule contented with the present system, and the fields of England prove that landownership on the part of farmers is not essential to good agriculture."

The history of agriculture in Dane County, Wisconsin, B. H. HIBBARD (*Bul. Univ. Wis., 1904, No. 101, pp. 68-214, figs. 3*).—This is an economic study of the agriculture of Dane County, tracing the changes which have taken place in the system of farming.

The movement of settlers to Wisconsin and the character of immigrants, the selection of land, and the precaution against land grabbing are interesting subjects taken up in the introduction. A discussion of the agriculture of the earlier period is centered about the wheat production, whereas that of the later period is centered about the introduction of the dairy industry, of the tobacco industry, and of the rise and fall of the hop industry.

The main object of this monograph is to outline the economic influences which made necessary the transition from the one-crop system, with wheat as the staple, which system prevailed during the early period when a virgin soil and a distant market were the principal factors in molding the farmer's economic life, to the complex farm organization of the present time, with cheese production, butter production, and tobacco culture as locally specialized industries superimposed upon a basis of mixed farming.

The book emphasizes the fact that the welfare of the farmer is closely dependent upon industrial and commercial conditions in the larger world of which he is a part; that in this larger world changes are constantly taking place which affect the prices of the products which the farmer has to sell, and upon which his profits depend; that as a result of these changes, the lines of production which are at one time most profitable, may at another time and under changed conditions as to market relations, prove relatively unprofitable; and that the farmer must ever be alert if he would so adjust the organization of his farm to the demands of the market as to secure the largest profits.

It is shown that the conservatism which leads the farmer to adhere to obsolete customs when it is clearly to his interest to reorganize his farm operations, is one of

the reasons why the necessary economic changes cause so much loss and suffering; but the difficulties which the farmer has to meet in readjusting himself to the changed conditions are also pointed out. It often happens that the necessary reorganization is expensive and he has not the money and can not secure the credit necessary for making the change. And, again, the conditions which influence the prices of farm products are so complex that it is very difficult for the farmer to distinguish between temporary and permanent changes in the prices of his products. This was shown to be especially true in the hop industry.

The book impresses upon the mind of the reader that the farmer must not only be alert in the carrying out of the operations of the farm, but he must be a man well informed on the price-determining forces, and an habitual thinker on the problems of farm economy, if he is to secure from his land and labor the greatest possible profits.

AGRICULTURAL EDUCATION.

The first book of farming, C. L. GOODRICH (*New York: Doubleday, Page & Co., 1905, pp. 259, pl. 1, figs. 86*).—The first part of this book is devoted to the general principles underlying plant culture, including discussions on the plant and the functions of the roots, stems, leaves, and flowers. Several chapters are given on the soil, with reference to the different kinds of soil, their moisture-holding capacity, and soil temperatures, together with the consideration of soil preparation, seed planting, and cultural operations. The second part of the work considers soil fertility as affected by farm operations and farm practices, and is devoted to discussions on soil fertility and its maintenance, methods of controlling the moisture condition of the soil, cultivation and rotation of crops, and the uses and value of farm manure and commercial fertilizers.

General laws relating to agricultural and mechanical land-grant colleges (*Rpt. Comr. Education [U. S.], 1902, Chap. 1, pp. 1–90; 1903, Chap. 2, pp. 39–226*).—A compilation of the laws of the different States concerning the donation of public lands, and the establishment, maintenance, etc., of land-grant colleges.

Farm mechanics in the Nebraska School of Agriculture, J. B. DAVIDSON (*Nebr. Farmer, 37 (1905), No. 27, pp. 653, 654, fig. 1*).—In this article the author discusses the need of general instruction in farm mechanics in all college agricultural courses, and outlines some of the essentials of such instruction. He also urges the necessity of specialized courses to meet the needs of agriculture in different regions.

Prospectus of courses of instruction in poultry keeping (*Univ. Col. Reading and Col. Poultry Farm, Theale, Prospectus, 1905, pp. 26, figs. 7*).—Outlines are given of short courses in poultry keeping, which are supplemented by other courses related to this subject.

Agricultural education as a factor in developing useful men, F. H. RANKIN (*[Urbana, Ill.], 1904, pp. 15*).—An address dealing mainly with agricultural college extension and agriculture in the rural schools.

Agriculture through the laboratory and school garden, C. R. JACKSON and MRS. L. S. DAUGHERTY (*New York: Orange Judd Co., 1905, pp. 403, pl. 1, figs. 150*).—This manual and text-book of elementary agriculture for schools was prepared to meet the need for instruction in a one-year course in agriculture for teachers at the State Normal School of Kirksville, Mo. It comprises chapters on the nature and formation of soils, classification and physical properties of soils, soil moisture and preparation of the soil, the soil as related to plants, leguminous plants, principles of feeding, rotation of crops, milk and its care, propagation of plants, improvement of plants, pruning of plants, enemies of plants, and ornamentation of school and home grounds.

Suggestions for experiments in laboratory exercises and field work are liberally interspersed throughout the book, and nearly every chapter is followed by references

to literature related to the subject under consideration. There are also appended lists of general references to publications, lists of agricultural experiment stations in the United States, and of publishing houses whose books are mentioned in the reference lists, and a glossary.

County normal training classes in Michigan, P. H. KELLEY (*Mich. State Supt. Pub. Instr., County Normal Bul. 1, 1905, pp. 15*).—The act enabling the different counties to maintain normal training classes with State aid is given, together with rules and suggestions relating to the conduct of such classes The teaching of agriculture is required in these classes and the conducting of school gardens is recommended.

Agriculture in Missouri schools (*Mo. Bd. Agr. Mo. Bul., 4 (1905), No. 12, pp. 44, figs. 6*).—This bulletin includes information regarding facilities and methods for teaching agriculture in the first district normal school at Kirksville, the second district normal school at Warrensburg, the third district normal school at Cape Girardeau, the College of Agriculture of the University of Missouri at Columbia, the Columbia High School, and the Columbia Normal Academy. Some of the courses are quite fully outlined, and numerous suggestions for laboratory work are made.

Studies suitable for elementary schools, P. MAGNUS ET AL. (*Rpt. Brit. Assoc. Adv. Sci., 1904, pp. 352–360*).—This report deals mainly with nature study, which the committee regards "as the sound foundation of all scientific training."

Report of Springfield Township Schools, Clark County, Ohio, A. B. GRAHAM (*Rpt. Springfield Township Schools, Clark Co., Ohio, 1904, pp. 47, figs. 36*).—The course of study for the rural schools of the township is given in detail, together with suggestions for supplementary work in nature study and elementary agriculture.

Improvement of school buildings and grounds (*Maine Ed. Dept., 1904, pp. 52, figs. 16, dgms. 6*).—In addition to suggestions for improving the architecture of school buildings, this pamphlet includes a sketch of the school-garden movement, and offers hints for the planting of school grounds and the location and use of school gardens.

School grounds and school gardens, R. A. EMERSON (*Agriculture* [*Nebr.*], *4 (1905), No. 4, pp. 10–26, figs. 2, dgms. 2*).—Detailed suggestions for the planning, planting, and care of school grounds and school gardens are given.

A study of school gardens and elementary agriculture for the schools of Michigan (*Mich. State Supt. Pub. Instr. Bul. 10, pp. 44–57, dgm. 1*).—A brief history of the school-garden movement is given, together with an account of agricultural schools in France and Russia, and suggestions for the care, culture, and management of school gardens.

Children's gardens, D. J. CROSBY (*Amer. Civic Assoc., Dept. Children's Gard. Leaflet 1, pp. 8*).—This is a prospectus of the department of children's gardens, dealing with the educational value of school gardens and the proposed work of the department in furnishing information regarding school gardens, and in conducting an active propaganda for their extension. A bibliography of recent school-garden publications is given.

School gardens and their relation to other school work, W. A. BALDWIN (*Amer. Civic Assoc., Dept. Children's Gard. Pamphlet 2, pp. 15, figs. 6*).—Suggestions are given for correlating school-garden work with arithmetic, language, drawing, and other subjects. Additional references to school-garden publications are given.

Cornell nature study leaflets (*N. Y. Dept. Agr., Nature Study Bul. 1, pp. 607, figs. 382*).—This is a selection, with revision, from the Teachers' Leaflets, Home Nature-Study Lessons, Junior Naturalist monthlies, and other publications from the College of Agriculture of Cornell University, issued between 1896 and 1904. The volume includes 80 of these reprinted leaflets, 50 of which are grouped in part 1 under the title, Teachers' Leaflets, and 30 in part 2, under Children's Leaflets.

MISCELLANEOUS.

A popular review of the work of the experiment station, E. B. Voorhees (*New Jersey Stas. Bul. 182, pp. 42*).—In addition to summaries of the numerous lines of investigation which have been carried on at the station during the last 25 years this bulletin contains a complete list of the officers and publications of the station since its organization to the present time.

Experiment Station Work, XXVIII (*U. S. Dept. Agr., Farmers' Bul. 222, pp. 32, fig. 1*).—This number contains articles on the following subjects: Home mixing fertilizers; sweet corn in the south; Kherson oats; cowpea hay; weight of feeds; grain rations; horse feeding; classification of swine; and silage for dairy cows.

Trade with noncontiguous possessions in farm and forest products, 1901-1903 (*U. S. Dept. Agr., Bur. Statis. Bul. 33, pp. 40*).—This is a compilation of the statistics of exports and imports of farm and forest products in the trade of the United States with Alaska, Hawaii, Porto Rico, Philippine Islands, Guam, and Tutuila during the 3 years ended June 30, 1903.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, vol. 7 (1905), Nos. 1, pp. 1-8; 2, pp. 9-16*).—These contain statements of the condition of crops in the United States on May 1 and June 1, 1905, and the usual statistical information on crops in foreign countries.

Report of the bureau of agriculture for the year ended August 31, 1904, W. C. Welborn (*[Philippine] Bur. Agr. Rpt. 1904, pp. 93, pls. 11*).—This report contains brief statements regarding the work of the bureau and reviewing the agricultural situation of the islands in general.

The introduction of live stock, principally cattle, is reported and work of the Singalong or Manila and Batangas experiment stations, the Government rice farm at Murcia, the San Ramon farm at Zamboanga, and the experimental college and experiment station at Negros is briefly noted. The report further includes a discussion of seed and plant introduction and soil and fiber investigations carried on, as well as of various agricultural industries.

The crops mentioned in the report are cotton, hemp, sisal, coffee, rice, corn, castor bean, cocoanuts, abacá, cacao, sugar cane, tobacco, and various fruits, vegetables, and forage plants. Culture tests of alfalfa and clovers were, in general, not successful, while velvet beans and soy beans made a most satisfactory growth. Sorghum, teosinte, Kafir corn, and similar forage crops produced excellent yields.

Report of the department of agronomy for 1904, J. Wolfbauer (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 3, pp. 192-206*).—A general report is given on work conducted by the agricultural chemical experiment station at Vienna. The different experiments in progress are described and some of the results obtained are discussed.

Plowing and subsoiling to a depth of 27 cm. gave profitable returns as compared with plowing 15 cm. deep, but the increase in yield differed considerably with the crops grown and also on different plats. The results are considered due rather to the mechanical improvement of the soil and a better conservation of soil moisture than to a higher nitrification. A discussion is given of the process of nitrification under field conditions and those obtaining in pot experiments.

NOTES.

Arkansas University and Station.—The State legislature has made the following appropriations for the experiment station: $9,000 for an agricultural building; $5,000 for a dairy building; $11,500 for salaries of agriculturist, assistant agriculturist, horticulturist, assistant horticulturist, entomologist, veterinarian, farm foreman, and dairy and live stock husbandman; $5,000 for maintenance of agricultural, horticultural, and veterinary departments; $2,000 for student labor; and $3,000 for substations. Frank P. Hall, Fayetteville, and Dougald McMillan, Arkadelphia, have been appointed members of the governing board, vice J. C. Mitchell and C. C. Hamby, retired. J. L. Hewitt has been appointed assistant horticulturist.

Connecticut State Station.—This station is erecting a two-story laboratory, covering an area of about 1,500 sq. ft., to supplement its present laboratory, which is much overcrowded. It is expected that the building will be ready for occupancy early in 1906. I. A. Andrew resigned from the station staff July 1 to take a position on a farm. E. M. East, formerly assistant in plant breeding at the Illinois Station, has been appointed to the station staff and will devote himself to the study of selection and breeding of corn.

Connecticut Storrs College and Station.—The State legislature has appropriated $40,000 for current expenses for 2 years, $3,600 for investigations in nutrition and dairy bacteriology, and $60,000 for the erection of a brick and stone dormitory to accommodate 66 students. The enrolment in the summer school for teachers and others in nature and country life subjects was 61.

Florida University and Station.—F. M. Stearns has been appointed foreman of gardens and orchards, vice J. H. Jefferies, resigned; B. H. Bridges, assistant chemist, vice R. A. Lichtenthaeler, resigned; and A. H. Chapman, assistant in agriculture, vice S. A. Robert, resigned. Mr. Jefferies goes to the North Carolina Station and Mr. Robert into private business. C. F. Dawson, whose resignation was previously noted (E. S. R., 16, p. 1139), has been elected consulting veterinarian to the station.

Georgia College and Station.—A movement was recently inaugurated looking to the removal of the experiment station to Athens, the site of the State University and the College of Agriculture and Mechanic Arts. This effort has met with decided opposition on the part of the citizens and authorities of Spalding County and the city of Griffin, and a countermovement has been made to move the State College of Agriculture and Mechanic Arts from Athens to Griffin, to be operated in close connection with the experiment station and entirely divorced from the university. Bills have been introduced and are now pending in the general assembly of Georgia looking to the accomplishment of these ends. The title of the dairy department of the station has been changed to that of department of animal industry, C. L. Willoughby remaining in charge. The work of this department will be extended to include experiments in feeding steers, and a barn for this purpose has been provided by altering and adding to an abandoned tobacco-curing building.

Iowa Station.—V. R. Gardner has been added to the station staff in horticulture.

Louisiana Stations.—P. L. Hutchinson, chemist in charge of the analysis of fertilizers and feeding stuffs, has resigned to accept a position in this Department, and his position has been filled by the appointment of J. E. Halligan. J. T. Felt has been appointed assistant chemist.

Maine University and Station.—Sanford C. Dinsmore, assistant chemist of the station, resigned July 1 to accept a similar position at the Nevada Station, and John B. Reed, for two years instructor in chemistry in the university, has been appointed to succeed Mr. Dinsmore.

Maryland Station.—E. P. Walls, assistant in agronomy, has resigned, and will take up the study of medicine at Johns Hopkins University.

Michigan College.—U. P. Hedrick, professor of horticulture, has resigned to accept the position of horticulturist at the New York State Station. Professor Hedrick has been succeeded by S. W. Fletcher of Cornell University.

Mississippi College and Station.—At the beginning of the present college year the dairy department of the college and station will occupy a new barn costing about $6,000. The building is T-shaped, the upright being 40 by 60 ft., 2 stories high, and the cross 240 by 35 ft., 1 story high. The former contains on the first floor a milk room and a bath room with cement floors, an office and several feed rooms with wood floors. The second story is devoted to storage for grain and roughage. The stable contains 100 stalls for milch cows, 6 box stalls for calves, and 6 box stalls for bulls. The stable floors are of cement and the stalls of brick to a height of about 6 ft. The framework and walls above the brick are of wood, mostly native pine. Both feed and manure will be handled by means of trolleys, the latter being carried by gravity to a manure shed some distance from the barn.

The summer school for teachers, held from June 20 to July 15, had an enrolment of more than 200 teachers. The industrial courses included agriculture, horticulture, nature study, school gardening, manual training, and drawing, and this feature of the work was so popular with the teachers that they passed resolutions asking that the school be held again next year.

Nebraska University and Station.—A. Keyser has been appointed assistant in agricultural chemistry. C. W. Melick, former instructor in dairying, has been appointed instructor in dairying at the Kansas Agricultural College. Provision has been made by the regents of the university for improvements costing about $30,000. These will include the erection of a new barn for pig feeding experiments, the rearrangement of cattle feeding barns and sheds, and the construction of a sewer.

Nevada University and Station.—The station staff has recently completed a ten-day tour through the eastern part of the State, where farmers' institutes were held at various places. C. R. Fitzmaurice has resigned as assistant chemist of the station and S. C. Dinsmore of the Maine Station has been appointed to take his place. N. E. Wilson, vice-director and chemist of the station, has been appointed dean of the university and consulting chemist to the station. S. B. Doten, station entomologist, has resigned to become principal of the university high school. J. E. Stubbs, president of the university and director of the station, has been given a year's leave of absence in order that he may rest and regain his health.

New Hampshire College.—Charles Brooks, formerly assistant in botany in the University of Missouri, has been appointed instructor in botany.

New Jersey Stations.—Equipment has been provided for investigations in plant nutrition in which the fertilizer requirements of soils will be studied with cereals and leguminous plants.

North Carolina College.—F. C. Reimer, formerly assistant horticulturist and botanist at the University of Florida and the Florida Station, has been made assistant horticulturist at the college.

Oklahoma College and Station.—W. R. Wright, a graduate of the Michigan Agricultural College, has been appointed assistant in bacteriology in the college and station, succeeding J. F. Nicholson, who, as previously noted (E. S. R., 16, p. 1141), has been made botanist and entomologist. C. E. Quinn, a graduate of the University of Nebraska, has been appointed assistant in soils and crops in the college and station during the leave of absence of L. A. Moorhouse. F. A. Hutto, principal of the school

of agriculture and domestic economy, has resigned. E. H. Riley, formerly assistant in animal husbandry in the college and station, has been appointed principal of the school of agriculture and domestic economy in the college and assistant in agriculture in the station. C. H. Tourgee has been relieved of station work and is no longer assistant in agriculture.

Pennsylvania College and Station.—Thomas I. Mairs, assistant professor of animal industry in the college, has been added to the station staff and placed in charge of the work in animal industry. Robert E. Stallings, assistant in animal nutrition in the station, has resigned to accept a position with the North Dakota Station. F. W. Christensen, of the U. S. Department of Agriculture, who served last year as assistant in connection with the animal nutrition experiments, has been appointed assistant in agronomy and animal industry in the station. A. W. Clark, assistant chemist, resigned July 19 to accept a position in the New York State Station. The division of botany of the station has been discontinued.

Porto Rico Station.—O. W. Barrett, entomologist and botanist of the station, has resigned to accept a position in the Office of Seed and Plant Introduction of the Bureau of Plant Industry of this Department.

Rhode Island Station.—In cooperation with the Bureau of Animal Industry of this Department the station has begun experiments in breeding turkeys with a view to controlling the so-called blackhead disease. George E. Adams, assistant in agronomy at the station, has been made associate agronomist.

South Dakota Station.—The agronomy division of the station has been put under the immediate supervision of the director, James W. Wilson. J. S. Cole, assistant in agronomy in the college, has been made assistant in agriculture in the station. An additional quarter section of land has been purchased recently by the State for the agricultural department, making in all a total of 480 acres for agronomy and live stock investigations. The first annual farmers' excursion to the college in June was very successful.

Tennessee Station.—H. A. Morgan, director and zoologist and entomologist of the station, has been appointed State entomologist and plant pathologist.

Texas College.—David F. Houston, president of the college, has been called to the presidency of the State University, and has accepted.

Utah College and Station.—W. W. McLaughlin has been appointed irrigation engineer; H. J. Frederick, veterinarian; E. G. Peterson, assistant entomologist; and C. W. Porter, assistant chemist. Robert Stewart, assistant chemist of the station, has also been made assistant professor of chemistry in the college. In compliance with a law passed by the last legislature discontinuing the engineering courses in the college, the board has decided to take no more new students in engineering, but provision has been made for those who have already entered to complete their courses.

Virginia College and Station.—The second annual meeting of the Virginia State farmers' institute, held at Roanoke on July 12, 13, and 14, was attended by over 500 farmers. On the last day of the institute an excursion train was run to Blacksburg for the purpose of visiting the college and station. Resolutions were adopted asking the State legislature to appropriate $100,000 for the development of college and station work.

Washington College.—The name of the Washington Agricultural College and School of Science has been changed to State College of Washington. The courses of study will remain the same as heretofore. J. J. Browne and S. G. Cosgrove have been appointed regents.

Wisconsin University and Station.—The following appointments have been made: D. H. Otis, of the Kansas Agricultural College, assistant professor of animal nutrition and assistant to the dean; C. A. Ocock, of the University of Illinois, assistant in agricultural engineering; J. G. Moore, assistant in horticulture; G. H. Benkendorf, assistant in dairying; and E. R. Jones, assistant in soils.

The last legislature passed an act requiring that all stallions used for breeding purposes in the State be registered and licensed by the department of horse breeding of the College of Agriculture, University of Wisconsin. The purport of the act is to necessitate the standing of stallions for what they actually are as regards breeding, and to weed out, so far as possible, sires that are notably unsound. It is expected that the effect of this new law will be to encourage the use of sound, pure-bred, pedigreed sires and lead to the more general recording of eligible colts, while at the same time discouraging the use of unsound, grade, "scrub," and crossbred sires. The act will take effect January 1, 1906. Dr. A. S. Alexander has been placed in charge of this department.

Domestic Science Work in Great Britain.—In Great Britain cookery and other branches of domestic science are attracting a good deal of attention, and work along these lines is encouraged through state and municipal aid, by the county councils, board of education, and in other ways. A large new wing, recently added to the Gloucestershire School of Domestic Science at Gloucester, was formally opened April 8. The board of education holds regular examinations in cookery, the chemistry of food, and the theory and practice of teaching nutrition. The interest in work along these lines is shown by the attention attracted by the sixteenth annual cookery and food exposition, which was opened May 2 by the Duke of Connaught, at the hall of the Royal Agricultural Society, Westminster. This exhibition was largely educational, and courses of lectures and demonstrations of the preparation of foods were given. A collection of ancient culinary implements, old cookery books, etc., was exhibited. The prize list was liberal, and the competitions arranged for army and navy cooks and for school children excited much interest.

Society of American Florists and Ornamental Horticulturists.—The twenty-first annual meeting of this society was held in Washington, August 15 to 17, with about 3,000 delegates and visitors in attendance. Prof. B. T. Galloway, of this Department, gave an illustrated lecture before the association in which he described the work that the Bureau of Plant Industry is doing along the lines of horticulture and agriculture in the introduction of new fruits, trees, and plants, and in the fostering of public interest in these subjects, both from an esthetic and industrial point of view. Miss Susan B. Sipe described the work of the Bureau of Plant Industry in encouraging civic improvement and the teaching of horticulture in the public schools of Washington. Other important papers presented at the meeting were Helps to Floriculture in the South and Southwest, by R. Nicholson, and The Ideal Country Home for the Man with a Long Head and a Short Purse, by Oglesby Paul. A number of essays on the Ideal Employer were submitted in competition for cash prizes. The first prize on this subject was won by S. S. Skidelsky. A committee of five was appointed by the president of the society to investigate the feasibility of preparing a text-book of horticulture for dissemination by florists' clubs and report at the next meeting. Dayton, Ohio, was selected as the place for the next annual meeting. The following officers were elected: President, W. F. Kasting; vice-president, H. L. Altick; secretary, W. J. Stewart. H. B. Beatty was continued as treasurer.

Dunn County School of Agriculture.—A recent bulletin of this school announces several lines of work which the school is prepared to do for the farmers of the country free of charge. This work includes testing of milk and seeds; inoculation of clover and other legumes; treatment of oats for smut and potatoes for scab; grafting of apple trees; planning of roads, barns, silos, poultry and milk houses, water systems, and drainage and sewage systems; selecting of pure-bred stock, and giving information regarding feeds, stock, crops, diseases, insects, spraying, and other farm subjects.

District Agricultural Schools of Alabama.—By recent action of the boards of control of the nine district agricultural schools of Alabama each boy in attendance at these schools will be required henceforth to work at least 2 hours a week at the school

farm, and each girl will be required to do practical work in floriculture and other kindred subjects.

Personal Mention.—General Roy Stone, the first chief of the Office of Road Inquiry of this Department and a distinguished veteran of the Civil War and the Spanish-American War, died at his home in Mendham, near Morristown, N. J., on August 7, and was interred with full military honors at the Arlington National Cemetery on August 10. He was 72 years of age.

General Stone was a pioneer leader in the movement for good roads in the United States. For many years previous to the establishment of the Office of Road Inquiry, General Stone had been agitating the improvement of the country roads, and in his home county he succeeded in perfecting a system of roads which served as a practical object lesson for the State of New Jersey and led to the building of a complete system of improved highways in that State. He was largely instrumental in securing the passage of the bill for the establishment of the Office of Road Inquiry in the Department of Agriculture, and when the law went into effect he was appointed by Secretary Morton as a special agent in charge, organizing and directing the work. With a limited appropriation, he did much to popularize the movement for good roads, and he inaugurated a system of object-lesson roads which greatly stimulated interest in the subject. Many instructive publications were issued under his direction.

Eugene Risler, honorary director of the National Agricultural Institute of France, died August 6 at the age of 77. His early agricultural studies were carried on at Grignon and Versaille in France and at Hohenheim and Regenwald in Germany, following which he traveled extensively, studying the agricultural conditions and practices in various countries. He became a frequent contributor to the French agricultural press, his first articles setting forth his observations on agriculture in the countries he visited. In 1856 he secured an estate of about 200 acres near Nyon in Switzerland and established there at his own expense the first Swiss agricultural experiment station. When the National Agricultural Institute was reestablished at Paris in 1876 Risler was made professor of comparative agriculture, and in 1879 he succeeded Tisserand, who had been appointed director of agriculture in the agricultural ministry, as director of the institute, a position which he held until his retirement in 1901. Among his numerous agricultural publications is his well-known treatise on agricultural geology, consisting of 4 volumes. A quite full account of his life by H. Hitier is given in No. 34 of the current volume of the *Journal d'Agriculture Pratique*, to the columns of which he contributed frequently ever since 1852.

W. H. Beal, of this Office, J. T. Willard, of Kansas, L. H. Smith, of Illinois, and W. L. Jepson, of California, were delegates to the International Congress of Agricultural Education at Liege, Belgium, July 28 and 29. The congress was well attended, about 150 delegates, representing 12 countries, being present. An international committee was appointed to give continuity to the work of the congress, Dr. A. C. True, W. H. Beal and L. H. Smith being the American representatives on this committee.

A. B. Graham, who as superintendent of Springfield Township Schools, Clark County, Ohio, has for a number of years been active in promoting agricultural education in the public schools, has been placed in charge of a newly organized department of agricultural extension in the Ohio State University. One of the features of the extension work to be undertaken will be the publication at regular periods of bulletins relating to the extension of agriculture in the rural schools.

John A. Widtsoe, who recently retired from the directorship of the Utah station, has become director of the agricultural department of Brigham Young University at Provo, Utah. For three or four years past the church schools have been giving attention to the teaching of elementary agriculture, and there is considerable demand for that kind of instruction at Brigham Young University. It is proposed to

strengthen this branch of the work at the university so far as funds at its disposal will permit.

Nature states that among the honors recently conferred by King Edward VII upon the occasion of his birthday was that of C. M. G. (Companion of the Order of St. Michael) upon James W. Robertson, late commissioner of agriculture and dairying of the Dominion of Canada.

William H. Kelley, chief veterinarian of the New York State department of agriculture, was a delegate for the United States to the International Veterinary Congress held at Budapest, Hungary, September 3 to 9.

Miscellaneous.—The first annual meeting of the Indiahoma Farmers' Union, including members from the Indian and Oklahoma Territories, was held at Tishomingo, I. T., July 18–21. The programme included addresses by J. A. Bonsteel and W. J. Spillman, of this Department; J. B. Thoburn, secretary of the Oklahoma Board of Agriculture, and P. G. Holden, professor of agronomy at the Iowa Agricultural College.

The Idaho Industrial Institute at Weiser, Ida., has recently erected and equipped a dairy building to handle the milk from a dairy of 40 cows, and is constructing a reservoir for irrigation purposes which will cost about $5,000.

The last report of the Royal Botanic Gardens at Peradeniya, Ceylon, advocates the establishment of a cotton experiment station in the dry region of north-central Ceylon, to be supplied with water from irrigation tanks. The soil is said to be excellent and the locality well suited to Sea Island cotton. The establishment of such a station is pronounced of primary importance.

Two numbers have been received of the *Kansas Agricultural Review*, a monthly magazine published by the students of the Kansas Agricultural College and devoted to agricultural education, college news, and notes concerning the alumni of the institution.

According to a recent note in *Science*, an agricultural conference was held at Aberystwyth, Wales, the third week in June, to aid in extending and developing the work of the agricultural department of the University College of Wales. The college is now receiving from the board of agriculture $4,000 for its agricultural department, $1,000 for a new farm opened on the day of the conference, and one-sixth of the "residue grant" to the County Councils for the counties connected with it. The County Councils were asked to appoint delegates to another conference to be held in October to consider details of a scheme of organization for the agricultural department of the college.

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EXPERIMENT STATION RECORD.

VOL. XVII. OCTOBER, 1905. No. 2.

Among the presidential addresses at the South African meeting of the British Association the past summer was one on irrigation, which is especially worthy of note on account of its treatment of the larger irrigation problems of the world. It brought together, furthermore, a large amount of information regarding the prominent features and conditions of irrigation in the principal irrigated countries. The address was delivered before the section for engineering by Sir C. Scott Moncrieff, president of the section. The speaker was competent to discuss the subject from his extended experience in the principal irrigated countries, and the study he has made of it from an economic as well as an engineering standpoint.

The paper served to show anew the enormous proportions which irrigation has attained, and the scientific basis which it has been placed upon in some of the countries of the Old World. It brought out in a rather striking way the similarity between the problems which are occupying special attention in other countries and those which are uppermost in this country, such as the pumping of water, utilization of artesian wells and of small reservoirs, the necessity for drainage as an accompaniment of irrigation, and the basis of payment for water. It also gave some striking illustrations of the colonization in India and elsewhere of vast tracts of country which, previous to the installation of irrigation works, were desert wastes.

The speaker characterized the irrigation in India and Egypt as being on the largest scale, that of Italy as having the most highly finished works and careful water distribution, and that of America as exhibiting rapid progress and bold engineering. "It is in India that irrigation on the largest scale is to be found," the Great Plains of northern India being peculiarly well adapted to it, and the teeming population absolutely dependent upon it for maintenance. As shown by the recent report of an irrigation commission, there are now under irrigation in that country something over forty-four million acres, or ten times the area at present irrigated in this country.

The greatest of its canals, discharging from 3,000 to 10,500 cubic feet of water per second, was built to carry water into a tract entirely desert and unpopulated. It was opened in 1892 and enlarged, and ten

years later was irrigating 1,829,000 acres, supporting a population of eight hundred thousand inhabitants, who were brought there from more congested parts of India. The Ganges Canal, opened in 1854, "at a time when there was not a mile of railway and hardly a steam engine within a thousand miles," has a length of nearly ten thousand miles, including distributing canals. Supplemented by the lower canal, drawn from the same river, it irrigates 1,700,000 acres annually.

A very bold and successful piece of irrigation engineering in southern India, which was completed a few years ago, diverts the waters of the Periyar River through the mountains to the plains on the other side. The river formerly descended to the sea on the west coast, where its waters could not be utilized, and large expenditures were required periodically to control its furious floods. A dam was built across its course and a tunnel made through the mountains, enabling the reservoir to be discharged into a system of canals to the east and applied to the irrigation of a vast area much in need of water.

In the state of Mysore a reservoir is now under construction which closes a valley containing over two thousand square miles by means of a masonry dam 142 feet high. The reservoir thus formed will contain 30,000 million cubic feet of water when filled, which, however, will rarely occur, the reason for the height of the dam being an engineering one rather than the need of ordinarily impounding such an enormous volume of water.

Perhaps there are no more familiar examples of the wonders wrought by irrigation than those furnished by Egypt, but to the layman Mr. Moncrieff's statement that purely agricultural land near Cairo, where the average rainfall is only 1.4 inches, is sold as high as $750 an acre is a revelation of the value which irrigation has placed upon these desert lands.

Here, it will be remembered, is the great Assuan Dam, six hundred miles below Cairo. This dam holds up a depth of sixty-six feet of water, forming a lake of more than one hundred miles in length, extending up the Nile Valley, and containing 38,000 million cubic feet of water. The chief object of this great reservoir is to enable perennial irrigation to be substituted in upper Egypt in place of the basin system of watering the land through the Nile flood only—that is, to enable two crops to be grown every year instead of one, and cotton and sugar cane to take the place of wheat and barley. It is expected that these works on the Nile will be finished in 1908. There will then have been spent on the great dam at Assuan, the minor one at Assuit, and the new canals of distribution in upper Egypt about £6,500,000, or approximately $31,525,000.

Not only will this undertaking have a far-reaching effect upon the agriculture of the country, the methods of cropping, and the handling

of water, but it is calculated that it will increase the land rental by over $13,000,000 and its sale value by upward of $130,000,000.

But in spite of these large enterprises, wells and small reservoirs are employed to a large extent in some countries, and have the advantage of placing the control of the water in the hands of the farmer. It was stated that about thirteen million acres, or 30 per cent of the lands irrigated in India, are watered by wells. Small reservoirs are also very numerous. In the native state of Mysore there are about forty thousand irrigation reservoirs, or practically three to every four square miles, and in southern India no less than ninety thousand of these small reservoirs are recorded.

The large volume of water required to be stored for an acre of land is often a matter of surprise to those who have not given the subject attention. Mr. Moncrieff stated that in India the storage of a million cubic feet of water does not suffice for more than six or eight acres of rice, while about one-third as much would be required for wheat. He speaks of districts so flat that to store water enough to irrigate an acre requires the drowning of more than an equal area; but as the irrigated acre yields eight or ten times as much as the unirrigated one, the idea is not as impractical as would at first appear. After the storage reservoir has been emptied it is often possible to raise a good crop on the saturated bed.

Improvement in the means of raising water is one of the most important of recent developments in irrigation. Measured by value, nearly one-tenth of the irrigated products of this country are now grown with water lifted by pumps. In the rice districts of Louisiana one-fourth of the outlay in growing a crop is for pumping; and manifestly the efficiency of the pumping machinery employed, which has been found in our own investigations to vary all the way from 5 to 82 per cent, has much to do with the profits of farming.

The centrifugal pump is rapidly coming into use in connection with irrigation, and is being extensively installed in this country where pumping is required. It is interesting to learn that these pumps are taking the place of the primitive shadoof, which has been for ages the method employed for raising water along the Nile. As the cotton and sugar cane crops in that country yield from $30 to $40 an acre, or even $50, the well-to-do farmer can afford a centrifugal pump run by steam power. There are now many hundreds of these pumps, fixed or portable, working on the Nile banks of Egypt.

Mr. Moncrieff was very strongly of the opinion that irrigation should be accompanied by drainage, a view which is coming to be widely held in this country. Speaking specifically upon the subject, he said: "In the great irrigation systems which I have been describing, for a long time little or no attention was paid to drainage. It

was taken for granted that the water would be absorbed or evaporated, and get away somehow without doing any harm. This may hold good for high-lying lands, but alongside of these are low-lying lands into which the irrigation water from above will percolate and produce water logging and marsh."

This is exactly what has happened in many places in our own country, rendering land practically useless and often causing it to be abandoned for cultivation. Where the evil has not progressed so far as this, alkali has taken possession of vast tracts of land, greatly restricting its value and the uses to which it can be put, and even rendering it unfit for any crops.

The speaker advised that the drainage canal should be constructed along with the irrigation canal, and he quoted no less an authority than Sir W. Willcocks in support of this. The latter states that the capacity of the drain should be one-third of that of the canal. "The two should be kept carefully apart—the canal following the ridges, the drain following the hollows of the country, and one in no case obstructing the other. This subject of drainage early occupied the attention of the English engineers in Egypt. In the last twenty years many hundred miles of drains have been excavated, some as large as fifty feet width of bed and ten feet deep.'

A survey like the above shows that in this country we are, relatively speaking, only at the beginning of irrigation development. A large proportion of our first efforts have been little more than temporary makeshifts, and have lacked that degree of stability and permanency which characterizes the works of the Old World and which is so important when we consider the dependence of arid agriculture upon irrigation. This dependence is not temporary, as are some conditions of agriculture, but is to be reckoned with as a permanent requirement of farming. Mr. Moncrieff, while mentioning some of our larger and better works, comments upon them as a whole as "often rude and of a temporary nature, the extensive use of timber striking a foreigner from the Old World." He also refers to the lack of a well-devised scheme of water control, such as exists in Italy and elsewhere.

It required time, of course, to convince capital of the possibilities of irrigated agriculture and to bring about a faith which warranted more permanent works; and as the experiments had all to be made by private enterprise the surprise is not at the imperfect character of these works, but at the public spirit and enterprise which have made some of our larger and more difficult works possible. Sir W. Willcocks has said that "if private enterprise can not succeed in irrigation works of magnitude in America, it will surely not succeed in any other country in the world."

Our progress now, both in the development work and the investigation of irrigation problems, is in line with that in other countries,

as judged by the above survey. With the Federal Government supplementing private enterprise in the construction of large projects and carrying on extensive investigations upon the use and economy of water, this important branch of agricultural development is placed upon a rational and intelligent basis which will make for greater permanency and stability.

Elsewhere in this issue a brief account is given of the meeting of the National Association of Agricultural Implement and Vehicle Manufacturers. This association holds annual meetings, and this year met at Niagara Falls the last of September. It represents interests which stand very close to agriculture, and the present development of instruction and experimentation in farm mechanics makes its deliberations a matter of special interest.

The development of agricultural implements and machinery has been very closely connected with our agricultural development and the increasing economy of production. It is calculated that in 1830 over three hours of labor were employed in growing a bushel of wheat, while in 1896 the labor aggregated only ten minutes; in 1850 the labor represented in a bushel of corn was four and one-half hours, while in 1894 it had been reduced to about forty minutes. As compared with the cost of production in 1830–50, modern machinery now grows crops for less than half, although operated by men who receive twice the wages paid formerly. Furthermore, the general quality of the product is better and it is handled in a more cleanly manner.

The American farmer buys annually one hundred million dollars' worth of farm implements and machinery, and the total assessed value of this portion of his equipment is $761,261,000. This is a vast investment, upon which he should realize good returns through being able to select implements which meet all the requirements for which they were purchased, and to secure the highest possible efficiency.

The introduction of power upon the farm is steadily increasing, and among the latest sources of power for this purpose alcohol is commanding wide attention. This material is already coming into use in Europe, where its application to a great variety of purposes in reducing hand labor and eliminating drudgery has been demonstrated. Its convenience, safety, and cleanliness commend it, and especially the possibility of its cheap production upon the farm. Alcohol motors have been perfected and machinery for distilling improved, and the German Government has encouraged the industry by removing the taxes from the product used for technical purposes. It is reported that raw alcohol is produced in that country from potatoes for 13 cents a gallon by processes so simple as to be within the reach of farmers. Already there is demand in this country for the removal of the taxes from alcohol used for technical purposes, the present revenue amounting to nearly fourteen times the cost of manufacture.

There is believed to be a wide field of usefulness open to the agricultural colleges and experiment stations and the National Department of Agriculture in connection with instruction and experimentation upon farm machinery and the application and economy of power. The results will be of substantial aid to both the farmers and the implement manufacturers. The men now employed by the manufacturers in designing and experimentation were often trained for something else, as there have been no schools for training men in agricultural mechanics; hence these men are often lacking in their knowledge of agricultural affairs, and this affects the efficiency of the experimental departments upon which the implement manufacturers have to rely to a large extent.

Already the experiment stations have been able to call attention to defects which manufacturers were glad to remedy, and to make suggestions for needed devices which would render the use of the machinery more efficient. The corn planter, which is still in a developmental state, furnishes illustrations of this, as does also the corn harvester. Resolutions commending the work of the experiment stations and the Department in this line, and indorsing the teaching of farm mechanics at the agricultural colleges, were unanimously adopted by the association, which pledged to these undertakings its cordial cooperation and support.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Formation of oceanic salt deposits, J. H. VAN'T HOFF (*Zur Bildung der ozeanischen Salzablagerungen. Brunswick: Vieweg & Son, 1905, pp. VI+85, figs. 34; rev. in Nature* [*London*], *71* (*1905*), *No. 1848, pp. 508, 509*).—This is the first instalment of a collection into one publication of the results of the well-known investigations of the author and his collaborators on the formation of double salts, the principal object of which was to study the problem of the formation of natural salt beds.

"The experimental basis of the work is the determination of the solubility, at certain temperatures, of the common salts of the sea, in water and in solutions of each other. With the information so obtained, it is possible to follow exactly the crystallization of a solution containing all these salts, as it gradually loses water by evaporation at the temperature of the experiment. The temperature most used is 25° C., which is fairly representative of the temperature of sea water evaporating in salt gardens, such as those of Hyères or Cadiz in summer.

"When average sea water has been evaporated down to the point at which chlorid of sodium begins to crystallize, the liquor contains (in molecular proportions) 100 NaCl, 2.2 KCl, 7.8 $MgCl_2$, 3.8 $MgSO_4$; and this mixture of salts is associated with, roughly, 1,000 molecules H_2O (exactly 1,064). On allowing this liquor to evaporate at 25° C., the crystallization follows a definite route, which can be traced exactly and without difficulty on one of those marvellous charts representing the march of physical and chemical phenomena with which the resourceful inventiveness of van't Hoff has familiarized us.

"The crystallization takes place in four acts corresponding to the regions in the chart.

"(1) Rock salt: Separation of chlorid of sodium in great abundance. Of the 100 NaCl present when crystallization began, only 4.6 NaCl remains dissolved; the remainder, 95.4 NaCl, has been deposited.

"(2) Kieserite region: Separation of chlorid of sodium, sulphate of magnesium, and kainit ($MgSO_4$. KCl. $3H_2O$). The salt separated in this act consists of 4.42 NaCl, 2.02 KCl, and 3.07 $MgSO_4$; or, 4.42 NaCl, 1.05 $MgSO_4$, and 2 02 kainit.

"(3) Carnallite region: Separation of chlorid of sodium, carnallite ($KMgCl_3$. $6H_2O$), and kieserite ($MgSO_4$. H_2O), and the amounts separated are 0.03 NaCl, 0.1 carnallite, and 0.35 kieserite.

"(4) Final liquor: What remains solidifies to 0.15 NaCl. 7.62 $MgCl_2$ (bischofite), 0.08 carnallite, and 0 38 kieserite."

A technical method for the determination of free phosphoric acid in superphosphates, GERHARDT (*Chem. Ztg.*, *29* (*1905*), *No. 14, pp. 178, 179*).—The method proposed is as follows: Shake 20 gm. of the superphosphate mixed with 1 gm. of ferrocyanid of potassium dissolved in a little water for ½ hour in 1 liter of water and filter; add a known weight of calcium carbonate to 100 cc. of the filtered solution and stir for ½ hour; remove the excess of calcium carbonate by means of a quick filter, wash a little, dry, burn, ignite carefully, and weigh. The difference between the calcium carbonate used and that thus obtained furnishes a means of calculating the free phosphoric acid.

Good results may be obtained by determining carbon dioxid by means of a Scheibler apparatus, or by dissolving the unused carbonate in hydrochloric acid and titrating with sodium hydroxid solution, using methyl orange as indicator. The solubility of the carbonate and the presence of iron and aluminum are the chief sources of error in the method.

A technical method for determining free phosphoric acid in superphosphates, R. ZÖCKLER (*Chem. Ztg., 29 (1905), Nos. 17, p. 226; 25, p. 338*).—The author believes Gerhardt's method to be unreliable, and considers the alcohol method simpler and safer.

Tables for reckoning the composition of ammoniated superphosphates, GERHARDT (*Chem. Ztg., 29 (1905), No. 15, p. 194*).—Tables are given which show amounts of ammonium sulphate and superphosphate of different grades which must be used in order to obtain mixtures containing desired percentages of nitrogen and phosphoric acid.

Analysis of compounds containing nitrogen in union with nitrogen by means of Kjeldahl's method, C. FLAMAND and B. PRAGER (*Ber. Deut. Chem. Gesell., 38 (1905), pp. 559, 560; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 509, II, p. 201*).—"Kjeldahl's method is applicable to azo-, azoxy-, and hydrazo-compounds which have been subjected to the following preliminary treatment: 0.15–0.2 gm. of the substance to be analyzed is mixed with 10 cc. of alcohol, 0.5–1 gm. of zinc dust, and 2–5 cc. of concentrated hydrochloric acid of sp. gr. 1.19, and heated until decolorization takes place. Ten cubic centimeters of concentrated sulphuric acid and 0.5 gm. of crystalline copper sulphate are then added and the mixture heated until white fumes are evolved. After addition of 6 gm. of powdered potassium sulphate, the liquid is heated until it becomes clear and light green. This method does not give accurate results with phenylhydrazin, benzylidenephenylhydrazin, and formazyl compounds."

The gravimetric determination of nitric acid by means of nitron according to Busch, A. GUTBIER (*Ztschr. Angew. Chem., 18 (1905), No. 13, pp. 494–499*).—The author reports a series of tests of the accuracy of Busch's method (E. S. R., 16, p. 945) under various conditions, especially solubility of the nitron and the nitron precipitate in water. The form of the method which he recommends and with which he obtained very accurate results is as follows:

Dissolve 0.1 to 0.15 gm. of potassium nitrate, or a corresponding amount of the other material to be tested, in 80 cc. of water in a beaker covered with a watch glass, add 12 to 15 drops of dilute sulphuric acid, and bring to boiling temperature; remove the flame and add to the hot solution 12 to 15 cc. of a 10 per cent solution of nitron in 5 per cent acetic acid; stir the mixture and allow to stand for ½ to ¾ hour, during which time the nitron nitrate will crystallize out. When the solution has attained room temperature place the beaker in ice water and after 1 to 1½ hours collect the precipitate on a weighed Neubauer crucible by decantation of the mother solution, using gentle suction, wash with 10 to 12 cc. of water at 0° C., dry, and weigh.

The qualitative determination of nitric acid by means of the diphenylamin reaction, G. FRERICHS (*Arch. Pharm., 243 (1905), p. 80; abs. in Chem. Centbl., 1905, I, No. 13, p. 957*).—The author calls attention to the fact that this reaction is interfered with by the presence of a number of substances, such as ferric salts, chromates, etc., and he describes a method of treatment with ether and sulphurous acid solution which overcomes some of these difficulties.

On Frerichs' method of determining nitric acid in water, UTZ (*Chem. Ztg., 29 (1905), No. 14, pp. 177, 178*).—This method (E. S. R., 14, p. 940) was compared with favorable results with those of Schulze-Tiemann and Mayrhofer.

A new method for determining ammonia, A. TRILLAT and TURCHET (*Bul. Soc. Chim. Paris, 3. ser., 33 (1905), No. 6, pp. 304–308; Compt. Rend. Acad. Sci. [Paris], 140 (1905), pp. 374–377; abs. in Chem. Centbl., 1905, I, No. 11, p. 832*).—This method,

which is claimed to be superior to the ordinary Nessler method, is based upon the fact that when 3 drops of a 10 per cent potassium iodid solution and 2 drops of a saturated alkali hypochlorite solution are added to 20 to 30 cc. of water containing ammonia, a black coloration is produced which can be easily compared with standard solutions as in the Nessler test.

Application of the nitrogen iodid reaction in determining ammonia in potable waters, A. TRILLAT and TURCHET (*Bul. Soc. Chim. Paris, 3. ser., 33 (1905), No. 6, pp. 308–310*).—A series of tests of the above described method on samples of water from different sources are reported.

On a new method of determining ammonia in ammoniacal salts applicable to the study of potable waters, A. TRILLAT and TURCHET (*Ann. Inst. Pasteur, 19 (1905), No. 4, pp. 259–265*).—A summary of the article by the same authors noted above.

On the physico-chemical analysis of cultivated soils, H. LAGATU (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 10, pp. 669–672, fig. 1*).—A uniform graphic method of representing the results of physico-chemical analysis is described and its applications briefly explained. (See also E. S. R., 16, p. 756.)

Determination of sulphur and phosphoric acid in foods, feces, and urine, W. L. DUBOIS (*Jour. Amer. Chem. Soc., 27 (1905), No. 6, pp. 729–732*).—A note on the calorimetric methods followed at the Bureau of Chemistry of this Department, particularly that of Neumann and Meinertz.[a] For earlier notes on the same subject see E. S. R., 16, p. 539.

The analysis of wheat and flour for commercial purposes, H. SNYDER (*Reprinted from Rpt. 5. Internat. Cong. App. Chem., Berlin, 1903, Sect. 6, vol. 3, pp. 9, pls. 2*).—The moisture content, acidity, total and alcohol-soluble nitrogen, the power to absorb water, microscopical characteristics, and other factors of value in determining the quality of flour are discussed, and methods of carrying out some of the determinations are described.

According to the author, "while no large amount of chemical work has yet been done in the way of testing wheat and flour for commercial purposes, the results which have been secured are sufficient to show that the milling of wheat is as capable of chemical control as is the sugar or any other industry."

The separation of proteids, H. C. HASLAM (*Jour. Physiol., 32 (1905), Nos. 3–4, pp. 267–298*).—On the basis of experimental evidence the author proposes methods, regarded as exact, for the separation of proteids by precipitation, one of which is dependent upon repeated precipitation and constant volume until the organic nitrate in the filtrate is constant in quantity, and another a method of fractional precipitation different from that of Pick.

"The application of these methods to proteids of serum and the digestive mixture shows that the various procedures (crystallization excepted) of previous authors in dealing with these complicated mixtures are quite inadequate to produce pure substances. Albumoses have been completely separated from peptones and other bodies. On this separation is based a method of estimating total mixed albumoses. Primary albumoses are shown to consist of at least three substances: Hetero-albumose, α-proto-albumose, β-proto-albumose."

The author states that "a particular proteid (or group of proteids) being precipitated, carries down with it large quantities of other proteids and also other substances, while large quantities of the proteid desired to be precipitated remain in the filtrate." It is suggested that "the best explanation of the tenacity with which these bodies cling to each other is to be found in the supposition that there is some sort of loose chemical combination among them. This hypothesis would also explain the fact that once a complete separation has been effected, if the products are arti-

[a] Ztschr. Physiol. Chem., 43 (1904), p. 37.

ficially mixed again, a second separation is not so difficult. It is also in harmony with our general knowledge of the chemical condition of the living organism.

"When the chemical equilibrium of such a system of proteids in loose combination is upset by the addition of a precipitant, only a partial separation is effected, some of the soluble proteids going into the precipitate and some of the insoluble remaining in the filtrate, the loose combination in these two cases being maintained. It is only by extensive and exact methods such as I have described that we can hope to effect the isolation of such bodies."

Simple proteids and their cleavage by ferments, A. KOSSEL and DAKIN (*München. Med. Wchnschr., 51 (1904), No. 13, p. 545; abs. in Hyg. Rundschau, 15 (1905), No. 9, pp. 451, 452*).—The simplest known proteid, according to the authors, is salmin, which gives 5 cleavage products, namely, α-pyrrolidin-carbonic acid, serin, amino-valeric acid, urea, and diamino-valeric acid or ornithin. Data are given regarding the cleavage products obtained by the action of erepsin on clupein, and the structure of proteids is discussed.

Investigations on the vegetable proteids, T. B. OSBORNE (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. 457-459*).—This is a brief summary of investigations which have been or are to be published in full in the *American Journal of Physiology*. The subjects investigated are as follows: The alcohol-soluble protein substances of wheat flour, the separation and purification of protein substances, the solubility of globulin in salt solutions, and the protein constituents of the castor-oil bean.

Detection of cotton-seed oil in lard, L. M. TOLMAN (*U. S. Dept. Agr. Yearbook 1904, pp. 359-362, pls. 4*).—The author points out the difficulty of detecting lard adulterants and the failure of ordinary tests for cotton-seed oil, and describes Bömer's test, which has been found successful in detecting cotton-seed oil in lard. This test depends upon the fact that phytosterol is present in vegetable fats but not in animal fats. While lard from hogs fed cotton-seed meal gave the usual color tests that would be given by products containing added cotton-seed oil, no phytosterol was present. Phytosterol may be identified by the form of the crystals or by the melting point of the acetate.

Investigations on the Gottlieb method of determining fat in milk, M. SIEGFELD and W. ROSENBAUM (*Milchw. Zentbl., 1 (1905), No. 6, pp. 244-248*).—Comparative tests of the Adams, Gottlieb, and Gerber methods are reported. The results by the 3 methods agreed closely on skim milk and whey. With buttermilk, however, the results by the Adams method were usually about 0.1 per cent lower than by the Gottlieb method. The substance insoluble in ether obtained in the Gottlieb method while not identical with lecithin is believed to be derived from that substance by oxidation during drying.

Studies on the possible saponification of fat by concentrated ammonia in the Gottlieb-Röse method, A. BURR (*Milchw. Zentbl., 1 (1905), No. 6, pp. 248-250*).—The results of the experiments reported indicate that ammonia does not cause a saponification of the fat in the determination of fat in milk by the Gottlieb-Röse method.

The identification of artificial coloring matter in fat, H. SPRINKMEYER and H. WAGNER (*Ztschr. Untersuch. Nahr. u. Genussmtl, 9 (1905), No. 10, pp. 598, 599*).—In the method described 10 gm. of melted fat is shaken with 10 cc. of petroleum ether. Fifteen cc. of glacial acetic acid is then added and the mixture thoroughly shaken and allowed to stand Added coloring matter is indicated by the yellow or pink color of the lower layer of the liquid.

A new automatic pipette, GREINER and FRIEDRICHS (*Ztschr. Angew. Chem., 18 (1905), No. 12, p. 465, figs. 2*).

Standard methods of sampling: A review with some suggestions, M. L. GRIFFIN (*Jour. Soc. Chem. Indus, 24 (1905), No. 4 pp. 183-185*).—A review.

The sampling of fertilizers, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), Nos. 17, pp. 533, 534*).—A brief discussion of general conditions and precautions to be observed in sampling, with directions for sampling fertilizers of different kinds and physical condition.

METEOROLOGY—WATER.

The Weather Bureau and the homeseeker, E. L. WELLS (*U. S. Dept. Agr. Yearbook 1904, pp. 353–358*).—This article discusses the history and causes of movements of population in the United States and explains how the climate and crop service of the Weather Bureau may aid the homeseeker in determining whether the proposed change will be advantageous and in making plans to meet the new conditions and to turn them to his profit.

Meteorological observations, W. T. ELLIS, R. ROBERTSON, W. S. BLAIR, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1904, pp. 17, 18, 313–316, 353, 354, 362, 409, 452, 485*).—Summaries are given of observations on temperature, precipitation, etc., during 1904, at Central Experimental Farm, Ottawa; Nappan, Nova Scotia; Brandon, Manitoba; Indian Head, Northwest Territories; and Agassiz, British Columbia.

Weather report, 1904, at the Ontario Agricultural College, Guelph, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 32, 33*).—A monthly summary for 1904 is given of observations at Guelph on temperature and precipitation. A summary is also given of mean temperatures, dates of first and last frosts for the 6 years 1899–1904. The general character of the weather of the year 1904, which was marked by large departures from the normal both in temperature and in precipitation, is briefly discussed.

Semi-annual bulletin of the Colorado College observatory containing the annual meteorological summary for 1904 (*Colo. Col. Studies, 11 (1905), Sci. Ser. Nos. 39–41, pp. 117–190, pl. 1, figs. 2*).—This bulletin contains an article by F. H. Loud on meteorological statistics, including notes on building, equipment, and exposure of instruments, and daily records and monthly summaries of meteorological observations; notes on meteorological topics by F. H. Loud, including discussions of topography, diurnal change of atmospheric conditions, the cold wind of October 24, and tables and charts relative to wind direction and movement, times of sunrise and sunset, etc.; and a paper on The Evolution of the Snow Crystal, by J. C. Shedd.

Meteorological observations, 1903–4, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 128, pp. 286–290*).—A summary is given by 10-day periods of observations at Fort Hays, Kans., on temperature, precipitation, cloudiness, prevailing winds, and general soil and climatic conditions during the period from March 1, 1903, to December 31, 1904.

Meteorological observations, J. E. OSTRANDER, G. W. PATCH, and C. H. CHADWICK (*Massachusetts Sta. Met. Buls. 197, 198, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during May and June, 1905. The data are briefly discussed in a general note on the weather of each month.

The weather during the agricultural year, 1903–4, F. J. BRODIE (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 381–392*).—A general discussion of the weather of Great Britain and Ireland during the winter of 1903–4, and the spring, summer, and autumn of 1904, with tabulated data relating to temperature, rainfall, and sunshine during the period.

Rainfall in southern Rhodesia during December, 1904, and January and February, 1905 (*Rhodesian Agr. Jour., 2 (1905), No. 4, pp. 157–159*).—The rainfall at 43 stations during this period is recorded.

Meteorological observations of Victor and Camille Chandon of Montdidier, H. DUCHAUSSOY (*Mém. Soc. Linn. Nord France, 11 (1903–4), pp. 25–221*).—Continuous

observations during 86 years, 1784–1869, are summarized. Data are recorded for pressure, temperature, rainfall, evaporation, casual phenomena, and phenological observations.

On the organization and conducting of meteorological observations, F. W. TOUSSAINT (*Fühling's Landw. Ztg., 54 (1905), No. 9, pp. 303–312*).—A general discussion of this subject.

Islands for weather forecasting purposes, W. J. S. LOCKYER (*Nature [London], 72 (1905), No. 1857, pp. 111, 112, figs. 2*).—The importance of meteorological stations on islands in the course of the rain-bearing winds of a country is explained, and the desirability of closer cooperation between the meteorological services of different countries is pointed out.

The régime of rainfall and of rain-bearing winds, M. CHASSANT (*Ann. École Nat. Agr. Montpellier, n. ser., 4 (1905), No. 4, pp. 297–326, pls. 7*).—This is a summary of observations at the meteorological station of the National School of Agriculture of Montpellier during the period from 1873 to 1904.

Data are summarized and discussed with reference to the absolute and mean depth of rainfall, the number of rainy days, the intensity of rainfall, the distribution of rain with reference to direction of wind, snowfall, and hailstorms. The maximum annual rainfall for the period was 1,037.5 mm. in 1875, the minimum 450.8 mm. in 1881. The mean annual rainfall for the whole period was 710.1 mm. The months showing the greatest rainfall during the period were October 82.4 mm., April 79.1, January 74.5, and November 72.8. The months showing least rainfall were July 25.9 mm., February 43.8, March 50.2, and August 52.1.

The average rainfall by seasons was as follows: Autumn 218.4 mm., spring 185.5, winter 174.7, and summer 131.4. The average number of rainy days annually during the period was 91. Rains occurred most frequently in spring, but the largest amount of rainfall occurred, as noted above, in autumn, showing more violent downpours during this season. The greatest amount of rainfall occurred with southeast and east winds, especially the first.

An average of 2 snowfalls per year during the period was recorded. The largest of these occurred February 10–13, 1890, and January 6–8, 1901, each being about 50 cm. in depth. Hailstorms occurred very rarely, that of June 28, 1874, however, doing considerable damage.

Measurements of the duration of sunshine at Aas Agricultural College, 1897–1903, J. SEBELIEN (*Ber. Norges Landbr. Höiskoles Virks., 1903–4, pp. 143–167*).—The author discusses the apparatus constructed by various scientists for making sunshine records and gives comparative results with several of these.

The main work was done with a Jordan photochemical apparatus, the registration paper of which was sensitized with an organic ferrisalt, the picture being developed and fixed in a solution of potassium ferricyanid. This apparatus registered sunshine at Aas (59° 40′ N. lat.) during the light season as early as 4.15 a. m., and as late as 9.30 p. m., which is about 1 hour after sunrise and about 10 minutes before sunset, respectively. The average results of the sunshine records for the years given are shown on the following page.

Average sunshine records, Aas Agricultural College, 1897–1903.

	Sun above horizon.	Registered sunshine.	In per cent of hours sun above horizon.	Maximum.	Minimum.
	Hours.	*Hours.*			
January	209.51	51.42	24.5	37.2	13.0
February	243.92	91.03	37.3	45.6	26.4
March	353.41	126.12	35.7	58.0	12.5
April	437.26	175.10	42.3	51.3	29.6
May	530.56	240.90	45.4	57.9	26.4
June	557.36	257.69	46.3	57.6	33.4
July	552.23	274.35	49.7	63.7	38.1
August	478.39	210.73	44.0	67.3	28.3
September	382.49	150.10	39.3	49.9	19.3
October	310.57	92.80	29.9	51.1	14.9
November	223.34	68.33	30.4	40.9	11.3
December	184.11	22.03	12.0	27.9	5.3
Total for year	4,463.14	1,741.17	39.0	49.2	33.5

The results show that the months which are generally considered dark as regards number of hours and days of sunshine are also dark in so far as they have the smallest percentage of theoretically possible sunshine. It is also apparent that the largest monthly variations in the percentage of sunshine occur during the summer months.—F. W. WOLL.

On the distribution of photochemically active light on the northern hemisphere at summer solstice, J. SEBELIEN (*Arch. Math. og Naturvidensk., 26 (1904), No. 9, pp. 13*).—The paper contains a discussion of previous work in this line by Wieler, Langley, Spitaler, Bunsen, and Roscoe, with results obtained by the author.

By means of the formulas of the last two scientists mentioned, the amount of photochemically active light is calculated which falls on midsummer day on a horizontal surface unit from sunrise to sunset for each tenth or fifth degree latitude. According to the calculations of the author the maximum number of light degrees of direct sunshine, 89,060, falls at 30° latitude and the maximum degrees of diffused light, 39,839, at the north pole, the total amount of light being highest at 30° latitude (114,835°). At 82° latitude as much chemical light is received on the longest day of the year through reflection from the sky as by direct insolation, viz, 39,000 light degrees.

The results of the calculations are platted and discussed in detail in the paper.—F. W. WOLL.

Photochemical studies of the ultraviolet part of sunlight, J. SEBELIEN (*K. Norske Vidensk. Selsk. Skr., I, Math. Nat. Kl., 1904, No. 9, pp. 59; Chem. Ztg., 28 (1904), No. 104, pp. 1259–1263*).—The paper is an exhaustive treatise on methods of measuring the intensity of the chemically active rays of sunlight, and of the author's researches on this subject. The latter were made mostly with Eder's reagent (ammonium oxalate and corrosive sublimate)[a] during the years 1898 and 1899. The detailed results are given in the paper.

The precipitates obtained were, on the whole, heaviest in summer and lightest in winter, but considerable daily variations occurred, viz, calculated on a 1 sq. cm. surface, from a few tenths of a milligram in December to several decigrams in June and July, the maximum precipitate ever obtained being 590.4 mg. (July 23, 1899). The relations of the data obtained by the author to cloudiness, northern lights, sun spots, etc., are discussed, and also the amount of photochemical light due to direct radiation and to diffused light.

The two kinds of light were found of equal intensity at an altitude of the sun of 30°, a result that closely corresponds to the determinations of Bunsen and Roscoe.[b]

[a] Sitzber. K. Akad. Wis. [Vienna], Math. Naturw. Kl., 2. Abt., 80 (1879).
[b] Ann. Phys., 108, pp. 254, 255.

The author's results fail to show any definite relation between photochemical intensities and the altitude of the sun.—F. W. WOLL.

On the importance of land drainage for the prevention of frost, A. G. HOGBOM (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 2, pp. 112–119*).—A discussion of the subject with special reference to conditions on moor soils.

Well waters from farm homesteads, F. T. SHUTT (*Canada Expt. Farms Rpts. 1904, pp. 191–193*). Analyses of 66 samples from different sources are reported and briefly discussed.

Ground water, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 8 (1904), Nos. 49, pp. 739–741, figs. 5; 50, pp. 771–773, figs. 7*).—A brief general discussion of the conditions which influence the percolation and level of water in soils and the formation of springs, etc.

The natural hardness of water, E. BASCH (*Chem. Ztg., 29 (1905), No. 14, pp. 176, 177; abs. in Chem. Centbl., 1905, I, No. 13, pp. 956, 957*).—The author points out the importance of making a sharp distinction between temporary and carbonate hardness, as well as between permanent and gypsum hardness.

The purification and sterilization of waters by means of calcium peroxid according to the Freyssinge and Roche method (*Ann. Chim. Analyt., 10 (1905), No. 4, pp. 149, 150*).—A brief description of the method.

Changes in the bacterial content of water in passing through a distributing reservoir, B. G. PHILBRICK (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 493*).—Routine weekly analyses covering a period of 10 years of the influent and effluent streams of Chestnut Hill Reservoir, Boston, are summarized.

Presence and distribution of nitrogen-fixing bacteria in the sea, KEUTNER (*Wiss. Meeresunters. Abt. Kiel, 8; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 509, II, p. 189*).—The author reports that the nitrogen-fixing bacteria *Azotobacter chroococcum* and *Clostridium pasteurianum* are widely distributed in the ocean, occurring on algæ and on plankton organisms. They are also found in many fresh waters. *A. chroococcum* was found to have the power of fixing nitrogen in an 8 per cent solution of sodium chlorid.

SOILS—FERTILIZERS.

Swamp soils, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 60, 61*).—Information regarding this class of soils in Ontario is summarized from replies to a circular of inquiry sent to farmers in different parts of the province, and the general chemical characteristics of the soils based upon analyses of 35 samples are briefly discussed.

"None of the soils could be said to be 'sour' or acid, although a few were rather low in lime. They, however, all contained a low percentage of both potash and phosphoric acid, much lower than the ordinary arable lands, and they were all exceptionally low in 'available' ash constituents. Some good authorities state that soils to be productive should contain as much as 0.03 per cent of potash and phosphoric acid in a form available for plants. Only a few of them reached this minimum limit, and many of them contained as small an amount as 0.005 per cent."

Abitibi soils, R. HARCOURT, *Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 62, 63*).—Analyses of 7 representative soils from this district are reported.

Soil investigations, F. T. SHUTT (*Canada Expt. Farms Rpts. 1904, pp. 145–151*).—Analyses of soils from British Columbia, Peace River district, and Ontario are reported and discussed.

The architecture of the soil of France, O. BARRÉ (*L'architecture du sol de la France. Paris: Armand Colin, 1903, pp. III+393, figs. 189*).—This book deals with the materials of the soil, its architecture or tectonics and sculpture; and the nature and results of geographic evolution, especially as applied to Central Europe. It

reviews the geological history of the region of France, and describes in detail the general geological formations found in that region.

Study of Belgian soils (*Bul. Agr.* [*Brussels*], *21* (*1905*), *No. 1*, *pp. 85-121*).—This is an account of conferences at which the following features of soil investigation in Belgium were discussed: Pot experiments with plants, physico-chemical analysis of soils, climatological observations, observations on natural flora, and organization of the soil studies.

On the composition of the moor soils of Jönköping County, R. TOLF (*Svenska Mosskulturför. Tidskr.*, *19* (*1905*), *No. 2*, *pp. 145-147*).

An apple orchard survey of Wayne County, New York. II, Geology, W. E. McCOURT (*New York Cornell Sta. Bul. 226*, *pp. 363-410*, *figs. 53*).—A detailed examination was made of the geology of Wayne County, New York; its geological history is given, and a description of the different soil types.

The control of soil moisture, F. T. SHUTT and W. S. BLAIR (*Canada Expt. Farms Rpts. 1904*, *pp. 157-164*, *359-361*).—The experiments here reported were a continuation of those of previous years (E. S. R., 16, p. 240) and were designed to ascertain (1) the effect of cultivation and mulching on soil moisture and (2) the relative amounts of water withdrawn from the soil by crops grown in different ways.

In the first series of experiments the crops made poor growth and the results were somewhat inconclusive; in the second the results "clearly indicate that much moisture may be saved by sowing the crops in drills and cultivating between the rows from time to time throughout the summer months." In a series of experiments at Nappan to determine the effect of different cover crops on the moisture content of orchard soil the results indicate that trees may be injured by exhaustion of the water supply in the soil by a growing crop of grain such as rye.

The absorption of water by clay, J. M. VAN BEMMELEN (*Ztschr. Anorgan. Chem.*, *42* (*1904*), *No. 3*, *pp. 314-324*).—Studies of the amount of water absorbed at 15° C. under varying pressures by soils which had been dried at 100° C. are reported, showing that the process of absorption is reversible, it being possible to repeat hydration and dehydration as often as desired. The rate at which absorbed water was expelled was not essentially different from the rate at which water itself evaporated under similar conditions.

The use of coloring matters in soil investigations, B. SJOLLEMA (*Jour. Landw.*, *53* (*1905*), *No. 1*, *pp. 67-69*).—It is shown how the fact that coloring matters, such as Congo red, alizarin, fuchsin, methyl violet, methyl blue, etc., form colored compounds with the colloidal substances of soils may be utilized in the microscopic examination of soils to distinguish between these substances and the quartz and other mineral constituents which are not colored.

The isolation of colloidal substances in soils, B. SJOLLEMA (*Jour. Landw.*, *53* (*1905*), *No. 1*, *pp. 70-76*).—A further study of the author's centrifugal method (E. S. R., 7, p. 752) with subsequent chemical and microscopic (with methyl violet coloration) examination of the separated products is reported.

Field trials of the Swedish Moor Culture Association, 1904, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr.*, *20* (*1905*), *No. 3*, *pp. 224-240*).—Reports of experiments at different moor plantations with regard to the best mechanical treatment and system of fertilization of moor soils for culture of small grains, legumes, hay, and root crops.

Some questions relating to soil culture, A. ARNSTADT (*Fühling's Landw. Ztg.*, *54* (*1905*), *No. 6*, *pp. 215-219*).—A general discussion of means of improving the physical condition of soils.

The action of ammoniacal salts on nitrification of sodium nitrite by the nitric ferment, E. BOULLANGER and L. MASSOL (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 10*, *pp. 687-689*).—Studies were made in the Winogradski and Omeli-

anski mineral medium containing varying amounts of sodium carbonate (0.15 to 1 gm. per 1,000).

From the results it is concluded that the amount of sodium carbonate may be reduced to 0.2 gm. per 1,000 without inconvenience, and if it does not exceed 0.25 gm. the transformation of nitrite is not interfered with by the addition of ammonium sulphate to the medium. If, however, larger amounts are present the free ammonia (but not the ammonium carbonate) formed retards the action of the nitric ferment.

Nitrification, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), No. 10, pp. 300, 301*).—A brief history of the discovery of the true nature of this process.

Nitrifying organisms, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), No. 11, pp. 332, 333*).—A brief account of the discovery by Winogradski of the fact that these organisms can develop normally in a purely mineral medium.

Nitrification in the soil.—The nitrous organism, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), No. 12, pp. 369, 370*).—This is a brief discussion of the investigations of Winogradski and others on the transformation of organic nitrogen first into ammonia, then into nitrous acid, and finally into nitric acid.

Nitrogen-fixing bacteria, H. FISCHER (*Jour. Landw., 53 (1905), pp. 61–66; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 509, II, p. 189*).—Of 6 samples of soil from differently manured plats only 2 from plats which had received lime were found to contain Azotobacter. The original soil of the plats was a heavy loam with only 0.145 per cent of lime.

The bacterial flora of the soil, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), No. 9, pp. 269, 270*).—A brief general statement regarding the specific rôle of different classes of soil organisms.

Investigations of the bacterial content of cultivated and uncultivated moor soils at Flahult, O. FABRICIUS and H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 2, pp. 84–90*).—Chemical and bacteriological examinations of 6 types of moor soils that were of different origin or had received different mechanical treatment were made at the moor culture station at Flahult, Sweden.

The results show that the white-moor soils in their natural condition contain only few bacteria, on account of the acid reaction of such soils. The bacterial flora is only slightly changed by mere drainage, but is greatly increased by liming, admixture with sand, manuring, and mechanical treatment, since the conditions for bacterial growth then become more favorable, and bacteria are moreover added in the sand and manure. The total number of bacteria in the soil is closely related to the soil temperature, and falls and rises with the latter. The number of bacteria on a well manured and well cared for high-moor plantation appears to be about as high as on a low-moor soil under similar physical conditions.—F. W. WOLL.

Methods of bacteriological investigation of soils, II, F. LÖHNIS (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 1, pp. 1–9; abs. in Chem. Centbl., 1905, I, No. 10, p. 768*).—In continuation of previous work, the author studied the behavior of soil bacteria under various conditions of medium and methods of culture. The behavior of the organisms under different soil conditions is also discussed.

The assimilation of atmospheric nitrogen by a peat mold, CHARLOTTE TERNETZ (*Ber. Deut. Bot. Gesell., 22 (1904), pp. 267–274; abs. in Centbl. Agr. Chem., 34 (1905), No. 3, pp. 205, 206*).

Mutual action of plant food compounds in the soil on their assimilation by plants, P. KOSSOVICH (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 5 (1904), No. 5, pp. 581–598*).—The hypothesis of Prianishnikov and Shulov (E. S. R., 14, p. 851) attributes the greater availability of phosphoric acid in crude phosphates in the presence of ammonium salts than in presence of nitrates to the fact that the ammonium salts are physiologically acid, and thus aid in the solution of the insoluble phosphates.

To further study this hypothesis the author made a series of experiments with

barley grown in sterilized sand, with various combinations of soluble and insoluble phosphates and with nitrogen in form of sodium nitrate, ammonium nitrate, and ammonium sulphate. Ingenious apparatus used to secure and maintain perfect sterilization, and thus to prevent nitrification, which the author considers the indeterminate factor in the investigations of Prianishnikov and Shulov, is described in detail.

The barley was sown July 25 and normally developed plants were harvested September 10. The author concludes from the results obtained that under the sterile conditions maintained the plant utilized equally well the nitrogen from nitrates and from ammonium salts. The form of combination of nitrogen, however, exerted a decided indirect influence on the growth of the plant and the assimilation of plant food by modifying the culture medium.

Plants receiving only nitrogen in form of nitrates took up relatively more acids than bases, thus causing an alkalinity of the nutritive medium, which may have exerted an injurious influence on the growth of the plant and influenced the ability of its roots to dissolve the needed plant food. When only nitrogen in form of ammonium salts was present, the plant took up relatively more of the bases than of the acids, and thus brought about an acid condition of the medium which was likewise injurious to plant growth, unless sufficient neutralizing material was present in the soil. This acid condition, however, facilitates the solution of other plant food constituents, such as the phosphoric acid in insoluble phosphates.

When nitrogen in form of both ammonium salts and nitrates was present, the plant utilized nitrogen equally from both sources without sensibly affecting the reaction of the medium. The conditions were in this case, therefore, most favorable for normal development.—P. FIREMAN.

On different degrees of availability of plant nutrients, O. LOEW and K. ASO (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1905), No. 4, pp. 335–346*).—The authors discuss the varying chemical availability of lime and magnesia and of phosphoric acid under different conditions, stating that Loew's hypothesis as to the most favorable ratio of lime to magnesia is predicated upon an equal state of availability of the two bases.

"This ratio changes, however, with the difference in availability, since of the more available form also more of the base will enter into the plant and thus the ratio offered to the roots and that which enters into the plant body will differ. Magnesia in the form of burnt magnesia is more available than in the form of pulverized magnesite and in the form of magnesium sulphate still more available. The amounts in which the easily available forms of lime or magnesia can produce the same result as 100 parts of the natural carbonates in the finest powder it is proposed to call the agronomical equivalent. This [factor] changes with the nature of the soils, and the partial transformation of the applied compounds into other forms in the soil.

"The action of lime and magnesia in physiological respect has to be distinguished from the actions these bases exert on the soil.

"The [reason] why lime in the form of gypsum acts differently from lime in the form of carbonate or slaked lime is the low degree of availability, since dilute acids do not increase the solubility. Even heavy doses of gypsum in the soil do not augment essentially the lime content of the leaves, and an excess of gypsum is not so injurious as an excess of carbonate.

"The decrease in harvest by liming certain soils is not always due to a diminution of the availability of phosphoric acid, but may in many cases be due to the production of a very unfavorable ratio of lime to magnesia. The magnesia content of soils has always to be taken in account when [lime and phosphatic manures are applied]."

The determination of the productiveness and plant food requirements of soils, J. KÖNIG (*Landw. Vers. Stat., 61 (1905), No. 5–6, pp. 371–396*).—A discussion of this subject based upon a critical review of literature relating to it, the subject

being considered from the standpoint of physical properties and chemical properties, including various methods of physical and chemical examination and fertilizer experiments.

Composts and composting, B. W. KILGORE ET AL. (*Bul. N. C. Dept. Agr., 26 (1905), No. 2, pp. 58–60*).—Formulas and general directions for preparing composts, especially those containing cotton seed and cotton-seed meal, are given.

Fertilizers and amendments, F. T. SHUTT (*Canada Expt. Farms Rpts. 1904, pp. 151–157*).—Analyses of wood ashes (leached and unleached), muck ashes, ashes from carbid works and from an incinerator, calcareous deposits from British Columbia, and whalebone are reported and discussed.

Analyses of cotton-seed meals (*South Carolina Sta. Bul. 105, pp. 6*).—Tables are given of analyses of 84 samples of meal collected as far as possible from all mills in the State. "The average ammonia yielded by the 84 meals analyzed was found to be 7.52 per cent. Eleven were found to yield 8 per cent or over of ammonia. Thirty-one were found to yield 7½ to 8 per cent of ammonia. Thirty-five were found to yield 7 to 7½ per cent of ammonia. Five were found to yield 6½ to 7 per cent of ammonia. Two were found to yield 6 to 6½ per cent of ammonia."

Analysis of commercial fertilizers (*South Carolina Sta. Buls. 97, 98, 99, 100, 101, 102, 104, 106, 107, 108, pp. 3 each*).—Tabulated analyses and valuations of fertilizers.

The utilization of ammonia nitrogen, A. SCHÄFER (*Fühling's Landw. Ztg., 54 (1905), No. 4, pp. 142–145*).—Investigations by Sessons on the effect of lime, temperature, and moisture on the loss of ammonia from soils are briefly reviewed, showing in brief that there may be considerable losses of nitrogen when ammonium salts are applied to light sandy soils rich in lime, particularly if the material is not thoroughly incorporated with the soil and the conditions made as favorable as possible for nitrification.

The use of peat for the transformation of calcium cyanamid into ammoniacal compounds, R. PEROTTI (*Atti R. Accad. Lincei, Rend. Cl. Sci. Fis., Mat. e Nat., 5. ser., 14 (1905), I, No. 3, pp. 174–177; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 510, II, p. 278*).—The injury due to the direct application of calcium cyanamid to growing crops is stated to be due to hydrolysis of the cyanamid, resulting in the formation of ammonium compounds. This hydrolysis can be brought about before application to the soil by mixing the cyanamid with peat and water. It is suggested that the hydrolyzed material may be used for the transformation of a fresh quantity of the cyanamid and the process thus repeated until a mixture very rich in nitrogen is obtained.

Nitrate of soda as a means of protection against frost (*Deut. Landw. Presse, 32 (1905), No. 31, p. 269, fig. 1*).—A case of frost resistance due to vigorous growth of flowers, vegetables, etc., resulting from applications of nitrate of soda is reported.

Value of potash to farm crops, J. J. WILLIS (*[Rothamsted], 1905, pp. 14, pl. 1*).—A discussion of this subject based upon Rothamsted experiments.

Is the availability of phosphoric acid in bone dust modified by the presence of gypsum? T. KATAYAMA (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1905), No. 4, pp. 353–356*).—A series of pot experiments with rice grown in sand to test the relative effect of calcium carbonate and calcium sulphate on the availability of the phosphoric acid of bone meal is reported.

The results show that the availability of the phosphoric acid was not depressed by gypsum, but was reduced to a marked extent by applications of calcium carbonate. It should be borne in mind, however, in connection with this latter fact that the artificial soil experimented with contained no humus. Very different results were obtained by Suzuki with a soil containing 11 per cent of humus, as noted above. Varying amounts of magnesium carbonate were used in connection with the calcium compounds. The results show that the larger amounts of magnesia did not act favorably.

AGRICULTURAL BOTANY.

The relation of plant physiology to the development of agriculture, A. F. WOODS (*U. S. Dept. Agr. Yearbook 1904, pp. 118-132*).—The author discusses the relation of plant physiology to the development of agriculture, paying particular attention to its rôle in plant breeding, the physiological action of plants in securing their nutrition, nature and causes of plant diseases, etc.

Regarding the cause of sap pressure and flow in the maple, K. M. WIEGAND (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 504*).—It is claimed that various investigators have shown that the seat of pressure in the maple during the sugar season is in the aerial parts of the tree, principally in the trunk, and pressure is induced by temperature acting as a stimulus. When the temperature passes 2–4° C. pressure results, but a freezing of the tissue is by no means necessary.

The author reviews the various theories regarding sap pressure, and concludes that the only adequate explanation is that pressure is due to the function of living cells. The pith rays seem to be the only ones in proper position in the wood to allow the production of pressure. In this case pressure would be due to the unequal permeability, in opposite directions, of the membrane at the ends of the cells. This would quite likely be caused by the penetration of the morning temperature. Water would tend to pass from the inner layers to the outer, and the sugar carried in solution would be excreted as a necessary factor in the production of pressure.

Further studies on the starch grain, H. KRAEMER (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 504*).—The author calls attention to the alteration of the compound starch grains in seeds of *Theobroma cacao* on the application of heat. Heat was found to transform the starch of cacao into masses resembling the natural starch grains of corn, wheat, rye, barley, and potato in size and shape, and in some cases even showing the concentric or excentric lamellated structures characteristic of those grains.

Notes are also given on the polariscopic examination of starch grains of different origin, in which it was found that in using a red and green selenite plate the yellow and blue areas of the starch grain did not occupy the same relative position in all of the grains. Different explanations are offered for this phenomenon, it being attributed to differences in shape and structure of the individual grains, difference in composition of the different parts of the same grain, or that there are two distinct kinds of reserve starch grains. This last hypothesis is believed to be the most plausible.

Further observations on the nature of color in plants, H. KRAEMER (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 499, 500*).—A preliminary account of the author's studies on the nature of color in plants has been given (E. S. R., 16, p. 540).

In the present paper the author summarizes his observations, claiming that plant color substances may be divided into 2 classes: Organized color principles, which are characterized by being an organic part of the plastid body and insoluble in water or dilute alcohol, but soluble in xylol and similar solvents; and unorganized color principles, which are not a fundamental or organic part of the plastid, but occur in the vacuoles in the cells of the higher plants and in the vacuolules of the plastids of the brown and red seaweeds. Unorganized color principles are soluble in water and dilute alcohol and insoluble in xylol and similar solvents.

In the photosynthetic processes of the plants the unorganized color substances may be produced, as in the early spring foliage, autumn foliage, foliage of alpine plants, brown and red marine algæ, and the foliage of certain varieties of roses, beech, nasturtium, etc.

The unorganized color substances are distributed ususally at the terminus of the branch, as in the foliage and flowers, or in the roots; but sometimes they occur in both tops and roots. The wide distribution of so-called flower color substances in other parts of the plant points to the conclusion that they are products of plastid

activity, and are not to be considered when found in the flower as designed primarily for the attraction of insects.

The occurrence of chromoplasts in a reserve organ and of reserve starch in the petals of certain plants suggests that these organs have a function of storing nutrient material.

Mutants and hybrids of the Œnotheras, D. T. MacDougal et al. (*Carnegie Inst. Washington Pub. 24, pp. 57, pls. 22, figs. 2, dgms. 11*).—The authors give the results of investigations carried on to determine the ancestral habitat of *Œnothera lamarckiana*, the relationship of this species to various others and to certain hybrids, the dominance of parental characters in hybrids, and the estimation of the fluctuating variability of some of the characters of different species.

The cultures of the evening primroses made at the New York Botanical Garden show that two or more elementary species are grouped together under some of the specific names as ordinarily accepted. The failure to recognize these elements has resulted in the prevalent opinions as to the wide range of variability exhibited by these plants.

It is evident that in the investigation of native species for possible mutating forms the first task to be completed is the resolution of the forms selected into their elementary constituents, and mutations may be taken as properly authenticated only when appearing in guarded pedigree cultures from seeds produced by a known individual, which should always be preserved for comparison. A study of various known mutants seems to indicate that mutation is induced or at least increased by favorable and not by adverse conditions.

The wild legumes of Maryland and their utilization, J. B. S. Norton and E. P. Walls (*Maryland Sta. Bul. 100, pp. 97-124, figs. 17*).—In this bulletin the authors furnish a list of the leguminous plants known to occur in the wild state in Maryland, showing the localities, kinds of soil, and surroundings where they grow best, and indicating the possible ways in which they may be utilized.

Suggestions are offered as to the possible improvement of some of the more promising species, experiments along this line being in progress at the station. After briefly describing the value of leguminous plants in restoring soil fertility, the authors take up the enumeration and distribution of species throughout the State.

Inoculation for the growth of legumes, F. T. Shutt (*Canada Expt. Farms Rpts. 1904, pp. 164-166*).—The author gives a brief statement as to the work that has been carried on at the Canada experimental farms relating to inoculation for the growth of legumes.

Experiments have been carried on with cultures prepared in Germany as well as those obtained from this Department, and the author states that as a result of his observations the necessity for inoculation is not as great as was once thought to be the case. In the Province of Ontario, at least, the failures to obtain a good catch of clover have been due to a deficiency of moisture, unsuitable mechanical condition of the soil, or insufficient drainage rather than to a lack of nitrogen-assimilating organisms.

A similar condition was found to prevail in British Columbia, and the author concludes that the severity of the winter, lack of moisture, uncongenial conditions of soil, or poor seed will be found to militate more against successful clover growing than any supposed lack of tubercle bacteria.

The proliferation of tobacco flowers, F. W. T. Hunger (*Ann. Jard. Bot. Buitenzorg, 2. ser., 4 (1904), pt. 1, pp. 57-60, pls. 2*).—Descriptions are given of a curious proliferation of tobacco flowers in which the character as a flower in some cases has totally disappeared.

Principles of classification of bacteria, F. D. Chester (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 485, 486*).—The author claims that as far as possible morphological characters should be the primary basis for the classification of bacteria, and for

generic classification the system of Migula, based upon the character of the flagella, is recommended. The division of genera into groups is based on leading characters, such as spore formation, relation to oxygen, liquefaction of gelatin, fermentation of lactose, dextrose, and saccharose, reduction of nitrates, and chromogenesis.

The effect of freezing on bacteria, E. F. SMITH and D. B. SWINGLE (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 481–483*).—The results of experiments made in freezing a number of different species of bacteria and other plant and animal pathogenic forms are given. Some of the freezings were made in liquid air with usually one-half hour exposure, while the others were made in salt and ice with an exposure of 2 hours. After freezing, thawings were made in tap water, and inoculations made from the cultures. These were sown on plates and the colonies counted after development.

The authors found that the effect of very low temperatures in destroying bacteria has been greatly overestimated. The results were as destructive with salt and pounded ice as with liquid air. The critical period of bacteria seems to be about 0° C., and if an organism can pass this point in safety it is believed that it would not be injured by any amount of cold that could be applied. In every culture some individuals were found that were unharmed when subjected to the temperature of liquid air (190° C.), although the number was a very small proportion of the whole. Repeated freezings and thawings gradually reduced the number of organisms present, although 10 freezings and thawings in the course of 8 hours did not kill all the individuals of the cabbage black rot organism (*Pseudomonas campestris*).

So far as any general inference can be drawn from the experiments, the authors conclude that bacteria behave very much like the higher plants and animals in respect to injury by freezing.

The metabolism of chromogenic bacteria, M. X. SULLIVAN (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 489, 490*).—Synthetic culture media are said to be the best for the biochemical study of bacteria.

Some bacteria show little power to grow upon synthetic media, but it is believed probable that the power to grow on such media can be developed and that the medium may be accommodated to the organism or the organism to the medium. Many bacteria grow readily on synthetic culture media with or without pigment formation. Whether producing pigment or not these chromogenic bacteria give the same metabolic products, as far as they have been analyzed.

The metabolic products so far investigated are various acids, ammonia, alcohol, benzol derivatives, and albuminous bodies. The metabolic products of a number of species are listed.

A review of the Bacillus subtilis group of bacteria, F. D. CHESTER (*Centbl. Bakt. [etc.], 2. Abt., 13 (1904), No. 24, pp. 737–752*).—The author gives a review of studies on the *Bacillus subtilis* group of bacteria, which is limited to those species of bacillus which produce spores, liquefy gelatin, and grow under aerobic conditions. The morphology of the bacteria is described, notes being given on the measurement, spore formation, germination, vegetative stage, etc., after which the cultural features, chemical functions, and classification of a number of species are discussed at length.

FIELD CROPS.

Field experiments with farm crops, W. SAUNDERS, J. H. GRISDALE, W. T. MACOUN, F. T. SHUTT, J. FLETCHER, C. E. SAUNDERS, R. ROBERTSON, S. A. BEDFORD, A. MACKAY, and T. A. SHARPE (*Canada Expt. Farms Rpts. 1904, pp. 19–37, 78–103, 128–131, 135, 136, 182–191, 255, 256, 259–281, 316–339, 371–389, 411–435, 453–466, dgm. 1*).—The results of experimental work with field crops at the Canada experimental farms in 1904 are reported. The work was carried on in continuation of experiments generally in progress for a series of years (E. S. R., 16, p. 246).

Wheat.—At the Central Experimental Farm at Ottawa a plat on which clover was plowed under in 1901 gave an increase in 1903 of 1 bu. 20 lbs. of grain and 360 lbs. of straw per acre as apparently due to the treatment. The following results were obtained by the chemist in studying the effect of rust on the straw and grain of wheat:

Analysis of rusted and rust-free wheat.

	Weight of 100 kernels.	Moisture.	Crude protein.	Crude fat.	Carbohydrates.	Fiber.	Ash.
	Grams.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Straw from rust-free wheat		7.92	2.41	1.65	39.00	39.95	9.04
Straw from rusted wheat		7.92	7.69	1.97	38.44	36.78	7.20
Grain from rust-free wheat	3.0504	12.26	10.50	2.56	70.55	2.29	1.84
Grain from rusted wheat	1.4944	10.66	13.69	2.35	68.03	3.03	2.24

The following crossbred varieties produced at this farm are described for the first time: Early Riga, Downey Riga, Riga, Bishop, and Red Preston.

At the Manitoba Experimental Farm at Brandon, seed from the largest heads selected from standing grain yielded 54 lbs. more per acre than unselected seed. Rusty wheat was cut at intervals of one week and the best results were obtained by cutting in the dough or late milk stage. In a series of experiments with barnyard manure, green manure, and fallow, the largest average yields of grain were obtained from the fallow plats. The fresh-manure plats gave larger returns than those treated with rotted manure, and peas were more effective as a green manure than clover. Plowing either 2 in. or 3½ in. deep made no appreciable difference in the results.

Of different spring varieties grown in a field test on the experimental farm for the Northwest Territories at Indian Head, Huron, a variety obtained by crossing White Fife and Ladoga, was earliest in maturing, requiring 118 days to complete its growth. This variety also led in productiveness, with a yield of 42 bu. 47 lbs. per acre. A comparison of 4 early and 2 late varieties showed that Preston, Stanley, and Huron mature in practically the same number of days. For 4 years fallow produced an average of 11 bu. 46 lbs. per acre more than stubble land. A test with commercial fertilizers for spring wheat at this farm resulted in favor of an application consisting of 200 lbs. of superphosphate No. 1, 100 lbs. of muriate of potash, and 100 lbs. of nitrate of soda per acre, half of the nitrate being applied as a top dressing when the grain was 2 in. high.

Spelt and emmer.—Ten varieties of spelt and emmer were under test at Ottawa. The best yield of grain per acre, 3,060 lbs., was obtained from single emmer (*Triticum monococcum*). This grain was only slightly rusted, while the other varieties were more or less seriously injured. At the experimental farm for the maritime provinces at Nappan, spelt gave larger yields than emmer, but a greater proportion of the crop was attacked by rust. These crops are reported as giving satisfactory yields in dry regions and producing a comparatively bright and clean straw.

Oats.—Regarding the influence of previous crops on the yield of grain and straw of Banner oats at Ottawa, it was found that the largest yield, 89 bu. of grain and 5,480 lbs. of straw per acre, was obtained where sand vetch was plowed under twice the preceding season. Of the new varieties added this year, which are briefly described, Garton Abundance ranged fourth in yield, and Daubeney and Gold Rain, a yellow sort, ripened early.

At Brandon an 11-acre field of Banner oats yielded 73 bu. 27 lbs. per acre, and a 5-acre field of American Beauty, 81 bu. 2 lbs., the weight per bushel being 37 and 38 lbs., respectively. In the average results for 4 years with oats grown in field lots at Indian Head, Banner led with a yield of 102 bu. 6 lbs. per acre, being followed by Abundance with 96 bu. 32 lbs.

Barley.—In 1904 Escourgeon, Black Japan, Eclipse, and Bere were added to the list of 6-rowed varieties at Ottawa. Of 30 varieties under test 13 are crossbred sorts produced at the experimental farms. In earliness the 6-rowed varieties have not differed much, but Mensury, Common, Odessa, and Stella were several days earlier than most of the varieties in the list. Champion appeared to be the best variety of the beardless 6-rowed type. Zero winter barley, a 6-rowed variety under experiment one season, partly winterkilled, but yielded at the rate of 41 bu. 32 lbs. per acre.

Of 27 varieties of 2-rowed barley under test, 10 are crossbred sorts originated at the farms. The earliest varieties in this list were Beaver, Jarvis, and Gordon. Yale, a 6-rowed sort obtained by crossing Duckbill and Rennie Improved, gave good results at Brandon, and has also given excellent returns at nearly all the experimental farms. Beardless varieties at this farm have been comparatively low in yield and weight per bushel. The 6-rowed varieties had the strongest straw and withstood lodging on summer fallow land, while the straw of 2-rowed Chevalier varieties has usually been too weak on such land. Among 9 varieties grown in field lots for 4 years at Indian Head, Claude ranked first in yield per acre with 63 bu. 4 lbs. and Royal second with 60 bu. 23 lbs. For 4 years fallow at this farm has produced an average of 21 bu. 6 lbs. more per acre than stubble land.

Rye.—At Ottawa 4 varieties of winter rye ranged in yields from 40 bu. to 70 bu. 40 lbs. per acre, the latest variety being Giant. All varieties remained free from rust. At Indian Head spring rye sown May 16 required 91 days to mature. The yield of grain was 18 bu. and that of straw 1,880 lbs. per acre.

Corn.—The cost of producing a ton of silage in the silo at Ottawa this season was $1.63, and the cost of producing an acre ready to feed from the silo was $21.25. Corn for silage grown in drills yielded 1,074 lbs. per acre more than corn in hills. As in previous years, rows 21 and 24 in. apart for the closest planting gave the best results at Ottawa, Nappan, Brandon, and Indian Head.

Peas.—At Ottawa, Chancellor appeared to be the earliest variety, ripening several days before Golden Vine. Of the 34 varieties tested 17 were crossbred sorts produced at the experimental farms. Laxton Charmer, with a yield of 58 bu. 40 lbs. per acre, was the leading variety of a number of garden peas grown in field lots at Indian Head.

Potatoes.—At Ottawa the average yields for 5 years of the 12 leading varieties ranged from 432 bu. 58 lbs. to 496 bu. 19 lbs. per acre. The 4 best varieties of the 12, mentioned in decreasing order of yield, were Professor Maercker, Late Puritan, Burnaby Mammoth, and Money Maker. The yields of 14 varieties tested in addition to the regular list in 1904 ranged from 308 to 545 bu. 36 lbs. per acre. The 3 leading varieties in this collection—Ashleaf Kidney Heber Rawlings, Dalmeny Beauty, and White Albino—yielded each over 500 bu.

Spraying this season was of much greater benefit to the late than to the early varieties. Where Bug Death and Bordeaux mixture were applied together an increase in crop value of $21.86 per acre was secured, as compared with $17.68 in the test where Paris green was used with the Bordeaux mixture. At Nappan the crop treated with Bordeaux mixture and Paris green gave the largest yield per acre, but Bug Death alone was quite as effective in killing the bugs as either Paris green or poisoned Bordeaux mixture. At the British Columbia Experimental Farm at Agassiz whole, smooth, even-sized seed potatoes, averaging from 2½ to 3½ oz. each, gave better results than large seed with not less than 3 eyes each and weighing on an average 1 oz., and seed cut to 2 eyes each and averaging about ¾ oz. in weight.

Flax.—At Ottawa, Yellow Seed and Novarossick, the most productive varieties for the season, yielded 20 bu. and 19 bu. 10 lbs. per acre, respectively. These varieties were medium early, while Russian and Common were earliest in maturing, requiring only 75 and 76 days, respectively, to ripen. At Brandon, La Plata with 23 bu. 32

lbs. and Novarossick with 22 bu. 8 lbs. per acre were the leading varieties. By sowing flax on new breaking at this farm a yield of 8 bu. 12 lbs. per acre was obtained, but the following wheat crop was reduced by 8⅗ bu. per acre as compared with new land not sown with flax.

On old land wheat after flax gave a yield of 43 bu. 40 lbs. per acre as compared with 37 bu. where it was grown after wheat, and still smaller yields where it followed oats, barley, millet, or summer fallow. The following yields are recorded for the different crops grown after flax: Wheat 43 bu. 40 lbs., oats 68 bu. 8 lbs., barley 52 bu. 44 lbs., and peas 53 bu. 20 lbs. per acre.

At Indian Head sowing 40 lbs. of seed gave the best results, while the yields obtained from plats sown at the rate of 20, 30, and 50 lbs. per acre were practically the same. Flax on flax stubble at this farm yielded only 9 bu. 33 lbs. per acre, while on 3 fallow plats from 12 bu. 24 lbs. to 19 bu. 18 lbs. per acre were obtained.

Buckwheat.—Five varieties of buckwheat were sown June 11 at Nappan, and harvested September 5. Siberian or Tartarian ranked first in yield, with 29 bu. 8 lbs. per acre, Silverhull with 22 bu. 24 lbs. standing next.

Root crops.—Turnips, mangels, carrots, and sugar beets were sown at Ottawa on May 17 and 31 and harvested October 14 and 28. In every instance the first sowing produced much the better yields. At Brandon, where similar tests are in progress the results were also in favor of the earlier sowing, while at Indian Head the second seeding gave better yields.

Grasses and other forage crops.—Of 5 different grass mixtures at Ottawa only 1 gave a larger yield than the usual mixture of 10 lbs. of timothy and 8 lbs. of red clover. A plat of 13.75 acres seeded to this common mixture yielded pasturage during the season valued at $10.41 per acre. Notes are given on different grasses and grass mixtures grown for hay. The best yield on the permanent pasture experiment plats, 6 tons 1,398 lbs., was secured from sainfoin sown at the rate of 40 lbs. per acre, while Awnless brome grass gave the lowest yield. The mixtures containing several grasses and clovers stood next to sainfoin this season.

Alfalfa, without a nurse crop, produced a more satisfactory growth at Nappan than when sown with wheat at the rate of 2 bu. per acre. At this farm Moha Green California millet yielded over 4 tons of green feed more per acre than Italian or Indian, and gave more than double the yield of Pearl, or Cat Tail, White Round French, Algerian, and Moha Hungarian. A mixture of 7 lbs. each of Western rye grass and Awnless brome grass gave good results at Brandon.

In a series of tests the highest yield of hay per acre, 2.7 tons, was obtained from a mixture of alsike clover and timothy, being followed by Mammoth red clover with 2.15 tons. The yields of millet at this farm were below the average, with the exception of Moha Hungarian, which yielded 6 tons of hay per acre. At Indian Head one-half acre of brome grass, plowed 2 in. deep in May, 1903, disked and rolled flat, gave this year 1 ton of hay without reseeding. Alfalfa sown in 1902 was almost entirely killed by the spring frosts, and this season Common, Utah, and Turkestan alfalfa and red clover sown in May gave very good results. Soy beans have generally given better results at Agassiz than horse beans, and the results with clover and corn for silage showed a difference of nearly 6 tons per acre in favor of clover.

Miscellaneous.—The average results of fertilizer experiments with wheat, barley, oats, carrots, mangels, and turnips, in progress since 1888 and previously described, were as heretofore in favor of the use of 12 tons of barnyard manure per acre, and indicated that fresh manure is of equal value with rotted material. The season's results at Ottawa with different fertilizer applications show that 800 lbs. of Thomas phosphate produced the largest yield of oats, 400 lbs. per acre of the same fertilizer produced the largest yield of clover, and 400 lbs. per acre of superphosphate the largest yield of Awnless brome grass. Clover as a green manure gave good increases

in the yield of a large number of cereal and forage crops. The results of a mixed crop experiment indicate that in general pure grains may be expected to give greater yields than mixtures.

In an experimental silo at Ottawa corn lost 15 per cent of its gross weight; a mixture of corn and rape, 33 per cent; and rape alone, 54 per cent. This material was put into the silo in September and taken out in March.

Of different methods of fall cultivation, shallow plowing in August, cultivating 3 times, harrowing 3 times, ridging the surface soil for the winter, cultivating once in the spring, and harrowing once at the time of sowing with the seeder produced the best results.

An experiment with 12 different crop rotations at Ottawa is described and the results thus far obtained are noted and given in tables. The results of similar tests at some of the other farms are reported without comment. Notes on summer fallow, deep and shallow breaking, backsetting, and working land after the first crop has been produced are given in the report from the Northwest Territories Experimental Farm. The cost of producing one ton and one acre of different kinds of hay at Ottawa is also given.

Experiments at Fort Hays Branch Station, 1902-1904, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 128, pp. 262-278, 291-302*).—A trial of seeding alfalfa on sod was begun in 1902, the field after breaking being disked both ways, harrowed twice, and worked with a subsurface packer. About 2 weeks later, May 6, it was harrowed again and after a shower on May 19, and as soon as dry enough the clod masher was run over the field and followed by another harrowing. A few days later a heavy rain fell which was all absorbed by the surface soil.

After the field had become dry alfalfa seed at the rate of 15 lbs. per acre was drilled in with a disk drill provided with press wheels. This work was finished on May 29, and on July 23, 57 days later, the alfalfa had begun to bloom and was mown. In 1903, 3 crops of hay were cut on this field, the first on June 12, the second July 23, and the last September 25. The total yield of hay was about 2½ tons per acre.

In 1902 wheat stubble was plowed and packed during July, and alfalfa seeded September 4 with disk drill and press wheels. A little over 10 lbs. of seed per acre was used. A good stand and a fair growth during the fall was obtained, and the fall seeding gave good results.

Bromus inermis was sown on sod which had received nearly the same treatment as the sod of the alfalfa field. Broadcasting the seed by hand was found preferable to using the drill. The field was sown May 29, but owing to heavy rains, only a thin stand was secured. On a higher piece of ground sown June 12 and harrowed before and after sowing, a very fine stand was obtained. Fall seeding of *Bromus inermis* did not give as good results. The following year, which was exceptionally wet, these fields of *Bromus inermis* made a very favorable growth.

In an experiment with fodder beets Golden Tankard yielded 9.1 tons and mangels 15.6 tons per acre. With irrigation the mangels yielded 21.1 tons. Notes are also given on Pearl millet, rape, melons, turnips, and a number of garden crops.

In a variety test with barley the yields ranged from 8.40 to 33.24 bu. per acre, the leading varieties being Telli, Black, and Six-rowed, all yielding over 30 bu. per acre. Harrowing and disking, or packing the land after plowing, were apparently the best methods of soil treatment.

Among the different macaroni wheats under test Yellow Gharnovka gave the best general results. Texas Red oats led all other varieties tested. The best yielding varieties of winter wheat were Theiss, Kharkov, Crimean, and Weissenberg, the yields being 40.97, 40.90, 40.61, and 39.53 bu. per acre, respectively. The best yield of wheat was obtained where the land was plowed, packed, and harrowed.

Where winter wheat was sown on sod, double disking gave better results than single disking or no disking, and sod broken in June or July produced a much better yield per acre than sod broken in April. Winter wheat on soy-bean stubble yielded 15.78 bu. per acre, and on corn stubble 12.33 bu. Notes are given on the culture and value of Kafir corn, sorghum, and grasses. Of the grasses grown *Panicum bulbosum* and *P. texanum* made a promising growth.

In 1904 the work begun in 1903 was continued. Among the varieties of winter wheat tested were a number of hybrids, and the plants secured showed great variations. In 1902, 150 varieties were planted and by selection in 1903 and 1904 these were increased in number to 350. Owing to attacks of rust the yields of winter wheat were low and the varieties of macaroni wheat were practically ruined. Barley and rye also proved a failure.

Of 6 varieties of oats Kherson gave much the best results, yielding 45.3 bu. per acre. The best yield from seeding Texas Red oats at different rates was obtained when 2 bu. of seed per acre was used. As in the previous season, harrowing and packing after plowing proved the best treatment for winter wheat. The cultivation of wheat by means of the harrow or the weeder was not profitable.

In 1904 surface-planted corn made a much more rapid growth and tasseled nearly a week earlier than the listed corn, and also ripened about a week sooner. The listed corn yielded 32.3 bu. and the surface-planted, 33.8 bu. per acre. Disking and harrowing before plowing did not have a marked effect on the yield.

The alfalfa sown on sod in 1902 gave favorable results in 1904, while the growth of *Bromus inermis* on the fields seeded the same year was too small to make a hay crop. *Panicum bulbosum* this season gave a very good yield.

A rotation experiment is in progress for determining the influence of fallowing, Kafir corn, oats, leguminous crops, and barley on the succeeding wheat crop. The best yields of wheat were obtained in 1904 after fallow and after soy beans.

Report on cultural tests in 1903-4, A. DAMSEAUX (*Bul. Agr.* [*Brussels*], *21* (*1905*), *No. 1*, *pp. 50-59*).—Among a number of varieties of different cereals Abundance wheat, Saxon rye, Hessian spelt, Hunsruck oats, and Groningen barley led in yield.

Schlitte sugar beet, the best of 4 varieties, gave a yield of 46,800 kg. per hectare, with 15.70 per cent of sugar in the beet and a purity of 87.20. The application of commercial fertilizers in the drill, as compared with applying the fertilizers broadcast, retarded the beets in their early growth, but they regained the time lost later in the season. The results from applications of barnyard manure and commercial fertilizers showed only slight differences in the yield and value of sugar beets, but they indicated the importance of working the manure into the soil as early as possible.

Fertilizer tests with potatoes proved inconclusive. An application of 2,500 kg. lime per hectare increased the yield of Campine and Bohemian clover by 1,200 kg. and of Lokeren clover by only 600 kg. Of a list of forage crops, excluding sacchaline, crimson clover produced the largest yield of green substance.

Results of fertilizer experiments in progress for ten years, C. VON SEELHORST (*Jour. Landw.*, *53* (*1905*), *No. 1*, *pp. 29-60*).—The results of fertilizer tests with rye, spring wheat, winter wheat, oats, barley, fodder beets, peas, beans, and potatoes are discussed.

The cereal crops were benefited only by nitrogen, potash and phosphoric acid producing little or no effect. The yield of peas and beans was largely increased by the use of potash, while nitrogen was also beneficial, but to a lesser degree. Nitrogen followed by potash caused the greatest increase in the yield of fodder beets. With potatoes the best results were secured where nitrogen and potash were given together. The data obtained did not warrant drawing definite conclusions with regard to the influence of the season on the action of the fertilizer.

A preceding leguminous crop largely increased the yield of rye. The use of nitrogen did not influence the proportion of grain to straw, but where rye followed potatoes the grain constituted 32.5 per cent of the plant where nitrogen was applied, and 30 per cent where no nitrogen was given. Winter wheat after peas lodged on the nitrogen plats, but when following rape and flax nitrogen in the fertilizer application was beneficial.

Where potatoes were grown after beans potash was more effective than nitrogen, but the highest yields were secured where both elements were applied together, while after cereals the use of nitrogen gave a greater increase in yield than the use of potash.

Tests of the vitality of seed grain and other seeds, W. T. ELLIS (*Canada Expt. Farms Rpts. 1904, pp. 15-17*).—This class of work, carried on at the Central Experimental Farm at Ottawa, is briefly described. During the season 2,285 samples of seeds were tested, and tables are given summarizing the results as a whole, as well as the results with wheat, barley, and oats for each province.

Trials of varieties of barleys (*County Northumb. Ed. Com., Ann. Rpt. 1904, pp. 39-44*).—Of 6 varieties Chevalier, Goldthorpe, and Golden Melon gave the highest yields of grain and straw. Chevalier also stood first in the percentage of germination. Sowing in drills 12 in. apart showed a slight advantage in yield of grain and straw, and in weight per bushel, over sowing in drills 6 in. apart, but the narrower drilling gave a little more good grain than the other.

The castor oil industry, C. M. DAUGHERTY (*U. S. Dept. Agr. Yearbook 1904, pp. 287-291*).—This article discusses the manufacture and uses of castor oil, the sources of supply of castor beans, and the distribution of the crop. The production of castor beans in the United States since the Civil War is reviewed.

Improved methods of corn growing and intense cultivation, J. B. ARMSTRONG (*Shenandoah, Iowa: Author [1905], pp. 156, pl. 1, figs. 13*).—A popular book treating of subjects of general interest to the farmer, and discussing more in detail and at greater length the culture of corn and potatoes.

Cotton cultivation (*Buenos Ayres: Argentina Dept. Agr., 1904, pp. 7*).—A brief discussion of cotton culture in Argentina. Sea Island cotton as well as a number of upland varieties, including Peerless, Peterkin, and Russell Big Boll, are reported to have been introduced from the United States.

Relation of weather conditions to growth and development of cotton, J. B. MARBURY (*U. S. Dept. Agr. Yearbook 1904, pp. 141-150, dgms. 6*).—This article discusses the influence of moisture and of sunshine on the yield of cotton, and reviews the weather conditions throughout the cotton belt for the years of greatest and of smallest yields in the decade beginning with 1893. Diagrams are given comparing the precipitation for the months of June, July, August, and September, and the yields of cotton for the years 1893 to 1903, inclusive. The climatic conditions of each year are considered with relation to the yield, but no general deductions are drawn.

Cotton culture in Guatemala, O. F. COOK (*U. S. Dept. Agr. Yearbook 1904, pp. 475-488, pls. 3, fig. 1*).—The native agriculture of Guatemala and cotton culture as practiced by the Kekchi Indians is described and the kelep in its relation to cotton growing is discussed. The introduction of the kelep into the United States with a view to demonstrating the possibility of keeping the cotton boll weevil in check is also briefly noted.

In discussing the American origin of upland cotton the author concludes that "the upland cotton which Linnæus correctly recognized as distinct from the Old World *herbaceum*, and to which he gave the Latin name *Gossypium hirsutum*, is a native of tropical America Both the upland and the Sea Island cottons were originally described from the West Indies"

Report of experiments with forage crops at the coast land experiment station, 1904, J. S. NEWMAN and W. D. GARRISON (*South Carolina Sta. Bul. 103,*

pp. 8).—The yields of 11 varieties of cowpeas, teosinte, barley, soy beans, oats, Canada field peas, cat-tail millet, Egyptian and crimson clover, Florida beggar weed, 6 varieties of wheat, alfalfa from 5 different sources, and hairy vetch and oats, are recorded without comment. The varieties of cucumbers and cantaloupes grown at the station are also given.

Forage crops. The silo, C. M. CONNER (*Florida Sta. Bul. 78, pp. 285-311, figs. 8*).—Brief discussions on the culture and uses of sorghum, rape, teosinte, rye, and Para grass (*Panicum molle*), and directions for the construction of a silo are given.

A bisexual hop vine, C. BRUNOTTE (*Bul. Soc. Sci. Nancy, 3. ser., 5 (1904), No. 4, pp. 173-179, pl. 1*).—The structure of the hop vine is described in detail, and an instance of a vine producing both male and female flowers is reported and discussed. Opinions of different authorities on the occurrence and significance of hermaphrodism in the hop are briefly noted.

The influence of soil moisture on the content of total and proteid nitrogen of oat straw, C. VON SEELHORST and FRESENIUS (*Jour. Landw., 53 (1905), No. 1, pp. 27, 28*).—It is known that an increase in soil moisture, other conditions being equal, causes a decrease in the nitrogen content of oat straw, and that this decrease is the more marked as the nitrogen supply of the soil diminishes. The work here reported has reference to the decrease in proteid and digestible proteid nitrogen.

Three varieties of oats were grown in 3 series of pots containing 55, 70, and 85 per cent of moisture in the soil, respectively. The results show that the rate of decrease is smaller in proteid nitrogen than in total nitrogen. The average percentage of proteid nitrogen in total nitrogen was 61.4 on the soil with 55 per cent of moisture and 86.5 on the soil with 85 per cent of moisture. The digestible proteid nitrogen decreased more rapidly with the increase of soil moisture than the total proteid nitrogen, as is shown by the fact that on the dry soil it constituted an average of 54.2 per cent of the total proteid nitrogen and on the moist soil only 44.3 per cent. The average percentage of digestible proteid nitrogen in the total nitrogen increased from 33.3 on the low moisture soil to 38.4 on the high moisture soil.

Canadian field peas, T. SHAW (*U. S. Dept. Agr., Farmers' Bul. 224, pp. 16, figs. 4*).—This bulletin contains a popular discussion of the Canadian field pea, with directions for its culture for different purposes. A similar article has been previously noted (E. S. R., 8, p. 781).

A description is also given of how this crop is grown in the San Luis Valley, Colorado, at an altitude of 7,000 ft., where it is used for fattening sheep and lambs by pasturing them on the crop. In the author's opinion this system of grazing may be very largely extended in the mountain States. Directions are also given for growing the crop for the purpose of fattening swine in localities where this crop can profitably take the place of corn.

The potato, S. FRASER (*New York: Orange Judd Co., 1905, pp. 185, pl. 1, figs. 51*).—This book devotes a chapter to each of the following subjects pertaining to potato culture: History and botany, some conditions influencing growth and development, soils, rotation, manuring and fertilizing, considerations of seed, varieties, planting, management of the growing crop, obstructions to growth and development, sprays and spraying, harvesting, storing, production, transportation and markets, chemical composition and feeding value, and breeding and selection. A spray calendar and methods of seed treatment, briefly stated, are given in an appendix.

The book of the potato, edited by T. W. SANDERS (*London: W. H. & L. Collingridge, 1905, pp. 222, illus.; rev. in Lancet [London], 168 (1905), No. 4264, p. 1346*).—This work treats of the history and botany of the potato plant, the soil and its cultural and manurial treatment, the propagation by seed, cuttings, eyes, and grafting, the preparation of the seed and systems of planting, forcing potatoes, harvesting, storing and marketing the crop, originating new varieties, and methods of combating

insects and diseases. A descriptive catalogue of 270 varieties is included in the volume.

Potato growing in New York, J. L. STONE (*New York Cornell Sta. Bul. 228, pp. 429–455, figs. 2*).—This bulletin summarizes the data on potato culture published by the station in previous bulletins, and presents other data accumulated since those publications were issued. The different operations and practices in connection with potato growing are discussed.

In 1903 a comparison of barn-stored wilted and sprouted seed and of solid slightly started cold-storage seed showed a gain of 159 per cent in yield in favor of the solid nearly dormant seed. In 1904 the seed tubers stored from November to May in crates in a cool cellar and with no sprouts started May 1, were divided into 4 lots, placed in trays, and stored in different ways from May 2 to June 7, and then planted. The first lot was kept in a dark cellar at a temperature of from 50 to 60°; the second, in a cold frame open above and with the bottom at 80°; the third, in a barn near a window where the temperature was about the same as out of doors; and the fourth, in a greenhouse at from 80 to 90°.

The second, third, and fourth lots gave a gain in yield of 35.1, 28.5, and 13.4 per cent, respectively, over the first. The sprouts on the tubers exposed to light were strong, dark green, and not over ½ to ¾ in. long, while on those stored in the dark cellar they were 3 to 4 in. long, whitish and brittle, and subject to injury in planting, especially if done by machinery.

A test was made of seed pieces of 2 different sizes, the one being as large again as the other. The smaller pieces were as large as those frequently planted by farmers. As compared with the larger pieces, the small pieces gave a yield reduced by 21.7 per cent on one plat and by 41.5 per cent on another. The effect of dusting the cut tubers with plaster one or two days before planting was studied by the station in 1903; in 3 out of 5 tests the increase in yield ranged from 13.31 to 26.18 bu. per acre on the plat planted with the treated seed. In the 2 other cases the results were inconclusive.

The culture tests carried on from 1894 to 1900 resulted in the best yields from 7 to 9 cultivations. Another series of tests showed that level culture is to be preferred to hilling. Spraying with Bordeaux mixture generally gave increased yields, although in some seasons when no blight appeared little effect was observed.

The results of cooperative variety tests made in 1903 and 1904 are given in tables. In one series of experiments Doe Pride stood first, in another Bovee gave better returns than Irish Cobbler, and in the third Gold Coin and Wilson 1st Choice stood about equal. The work of potato diggers and planters is discussed, and an outline of cooperative demonstrations to be made in 1905, comprising different phases of farm work, is given.

Potato culture near Greeley, Colorado, J. M. CLARK (*U. S. Dept. Agr. Yearbook 1904, pp. 311–322, figs. 6, pl. 1*).—The extent of the potato area near Greeley, the markets, irrigation, and alfalfa culture as factors of success in potato growing, crop rotation, and sheep feeding in the potato belt, the preparation of seed potatoes, and the methods of growing the crop, including the application of water, are discussed.

Observations on the influence of nodules on the roots upon the composition of soy beans and cowpeas, C. D. SMITH and F. W. ROBISON (*Michigan Sta. Bul. 224, pp. 125–132*).—The yield and composition were determined of roots, stems, and leaves of Medium Green soy beans grown in 1903 on two areas, the roots in one case being practically free from nodules and in the other nearly covered with them. The leaves and stems from an 8-ft. row bearing nodules weighed 5,125 lbs., and from a similar area without nodules 5,562 lbs. The roots with nodules weighed 0.438 lb., and those without 0.625 lb., the nodules themselves weighing only 0.16 lb.

In 1904 this work was repeated on two plats, each containing a square rod, the one being inoculated with soil from a soy-bean field, and the other being left with-

out inoculation. During the season the roots of the plants on the inoculated plat were well covered with nodules, while those on the uninoculated plat remained free from them. No difference was apparent in the growth on the two plats or in the color of the foliage. A row 8 ft. long on the inoculated plat contained 52 plants, weighing 4 lbs. 5 oz., and on the uninoculated plat 49 plants, weighing 3 lbs. 12 oz. The roots weighed 9 and 6 oz., respectively.

As a mean of the two years, the leaves and stems of the plants bearing nodules contained 2.78 per cent of nitrogen, and the others 1.77 per cent in dry matter. The roots bearing nodules (latter removed) averaged 1.01 per cent of nitrogen in dry matter, and those having no nodules 1.43 per cent. "Inoculation does not seem to notably affect the phosphoric acid nor the potash." In each year the percentage of protein was higher in the inoculated plants, the protein content for the two years taken together being 56.86 per cent greater in the plants from the inoculated plats.

A similar experiment with cowpeas, made in 1904, showed a corresponding predominance of nitrogen in the leaves and stems where nodules were produced, and a decrease in the roots. The cowpeas with nodules on the roots contained 47 per cent more protein than those without nodules.

Analyses of the nodules showed the following composition: Soy-bean nodules—protein 26.19, nitrogen 4.19, potash 2.05 per cent; cowpea nodules—protein 24.39, nitrogen 3.90, phosphoric acid 0.96 per cent. In all except one case the roots without nodules contained a greater percentage of nitrogen than the roots provided with them.

An estimate based on the composition of dry matter of the leaves, stems, and roots of the two crops and the yields of plats 0 8 and 1.29 acres in size shows that the inoculated soy beans contained 113.55 lbs. of nitrogen per acre, as compared with 75.98 lbs. from the uninoculated, and the inoculated cowpeas 139.21 lbs, as compared with 118.45 lbs. in the uninoculated crop. The figure for the cowpeas does not include the nitrogen in the abundant nodules.

In a study of the influence of nodules upon the composition of the seed of soy beans it was found that the ripened seeds of the inoculated soy beans were fully 16 per cent richer in protein than the product of the uninoculated areas. The authors conclude that the nodules on the roots on fairly fertile soil may not notably increase the yield, but that they do increase the relative and absolute amount of nitrogen in the plants.

Tests of different varieties of sugar beets, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 51-54*).—Four years' results with different varieties of sugar beets are reported.

The tests comprised 32 varieties, of which 20 were grown for 4 years, 8 for 3 years, and 4 for 2 years. The beets were grown in level culture in rows 21 in. apart and at 8 in. apart in the row. In 1904 Mangel Sugar Beet, Rimpau Rubensamen, Jaensch Victrix, and Improved Imperial ranked first in quality. The sugar content in these varieties ranged from 17.4 to 18.5 per cent and the coefficients of purity from 83.8 to 90.3.

In the list of varieties tested for 4 years Kleinwanzlebener, Improved Imperial, and Pitzscheker Elite ranked first in average quality. Kleinwanzlebener showed an average sugar content of 16.9 per cent and a purity of 88.1. Among the varieties grown for 2 years Rimpau Rubensamen stood first in average results, with a sugar content of 17.6 per cent and a purity of 89.5.

A study of the influence of the distance between rows on the quality indicated that the best quality of beets is obtained in rows 18 or 20 in. apart, and that wider planting reduces the quality and produces a marked decrease in yield. A brief report on the beet-sugar industry in Ontario is given.

Sugar-beet seed breeding, J. E. W. TRACY (*U. S. Dept. Agr. Yearbook 1904, pp. 341-352, pls. 3*).—The effect of good seed on the quality of the beet, and the advan-

tages of growing sugar-beet seed at home are pointed out. Methods for the production of high-grade commercial seed are outlined, the different steps in scientific growing of sugar-beet seed are summarized, and the work of this Department in this line is briefly reviewed.

Field experiments with sugar cane, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 13, pp. 17, plans 3*).—This bulletin considers briefly a few of the more important points in connection with practical tests with sugar cane in the field, and indicates some of the sources of error which may occasionally arise.

In considering the modifying influences which may tend to impair the results obtained during short periods a simple plat irrigation experiment is taken as an example, and the nature of plats, preparation of land for planting and the seed cane used, and the treatment of plats with special reference to irrigation are described. The actual difference in weights of cane and sugar per acre which may arise from apparently trifling variations in the growth of the individual cane plants is pointed out, the figures used being based on an increase in diameter of the cane by $\frac{1}{1000}$, $\frac{1}{100}$, and $\frac{1}{32}$ of an inch. Diagrams are presented to illustrate the manner in which small experiment fields, either with or without irrigation, could be laid out to best advantage.

The improvement of tobacco by breeding and selection, A. D. SHAMEL (*U. S. Dept. Agr. Yearbook 1904, pp. 435-452, pls. 7, fig. 1*).—This article points out the need for the improvement of tobacco and its adaptation to soil and climatic conditions, discusses the value of large and heavy seed, including the description of a method for the separation of the light from the heavy seed, and gives general directions for improvement by selection. Record outlines for noting the characteristics of individual seed plants and the development of the progeny are given.

The results of experiments in selection, showing the influence of plant individuality, are reported. Ten separate and distinct types were observed in a field of Sumatra tobacco and seed was selected from the typical plants in each type. In the young plants produced from this seed the characteristics of each type were quite apparent and became more prominent as maturity approached. It was further observed that the progeny produced about the same number of leaves as the parent plants, in which the number had ranged from 4 to 40. An increase in the number of leaves was not associated with an increase in the height of the plants, but the length of the internodes was reduced as the number of leaves increased.

The shape of the leaf in the parent plant was reproduced in the progeny, and in this connection the value of wide leaves with rounded tips and bases is pointed out. "It has been conclusively proven that any shape of leaf desired, which is produced in a given locality, may be fixed and transmitted uninterruptedly to the succeeding crops by selection of the parents having the desired shape of leaf and saving the seed of such plants under bag." It was also found that the size of the leaf can be controlled by selection. Seed from plants free from suckers produced proportionately few suckers, while seed from freely suckering individuals produced plants with large numbers of suckers.

In 1903 the author selected plants apparently resistant to a root disease attacking Sumatra tobacco. "The progeny from these plants were resistant to the disease and produced a profitable crop of tobacco while the plants grown from other selected seed were as seriously injured as in the previous year." These results are believed to suggest the possibility of breeding types resistant to many of the common tobacco diseases.

The improvement of tobacco by crossing varieties is also briefly noted. The progeny of crosses made in 1903 with native and imported variety of cigar tobacco showed a great improvement in quality, vigor of growth, and yield over the native types. The shape of the leaf was materially modified, especially in hybrids of Havana seed and Cuban and Havana seed and Sumatra, the leaves, very round, with regular and uniformly fine veins from the tip to the base, were of finer and

more elastic texture than Havana seed and made better wrappers. The results were even more striking in the crosses in which Broadleaf was used as the mother parent.

The selection of tobacco seed plants, A. D. SHAMEL (*Connecticut State Sta. Bul. 150, pp. 18, pls. 5*).—A somewhat fuller discussion of this subject by the author has been noted from another source (see above). This bulletin treats of the possibility of improving the quality of tobacco, the lack of uniformity of plants in the average tobacco crop, self-fertilization and cross-fertilization in the plant, advantages of using seed from self-fertilized flowers, and methods of selecting plants and securing self-fertilization.

In all the crops grown from imported seed a large proportion of abnormal plants, in type as well as maturity, were observed. This was especially true of the crops from freshly imported Cuban seed, in a field of which the author found about 33 per cent of the plants to be of freak type. The variation in type of the Broadleaf Havana seed and of so-called native varieties was less marked, but the individual variation in the number, shape, and size of seeds, the number of suckers, the number of seed pods, and other characters was nearly as great as among plants grown from imported seed.

It was observed that some plants had nearly double the number of leaves found on average plants, and many individuals produced rounded leaves, while others bore long, narrow, and pointed leaves. Some plants suckered profusely, while in others this tendency was comparatively weak. Again, plants were observed with from 150 to 200 seed pods, while others bore only from 25 to 100. In maturity of leaf a difference of 2 weeks was noted between individual plants, and it was found that the leaves of plants in the same field varied in body, stretch or elasticity, color or appearance, and other characteristics.

In the discussion of self-fertilization and cross-fertilization of tobacco the flowers of the plant are described and the natural method of fertilization is pointed out. For 2 years experiments were made with Connecticut Havana, Broadleaf, Sumatra, and Cuban types grown under cloth and in the open, and on a commercial scale, to determine the relative value of seed produced by exclusive self-fertilization and of seed produced by natural cross-fertilization. The results show that the plants from self-fertilized seed produced exactly the character of the mother plant. The individual character, such as shape and color of leaves, number of leaves and suckers, body or texture, size of veins, time of maturity, and all other observed characters were uniformly transmitted.

In a field of Connecticut Sumatra several hundred plants of different types were selected and seed exclusively from self-fertilization was secured. From this seed a type was produced with leaves which would not burn, and with it another type tested in the same way which had the most perfect burn of any kind of tobacco. In one instance imported seed produced plants which were attacked by a fungus root disease and destroyed, together with certain individuals which were resistant or immune and produced ripe tobacco of excellent quality. Some of the plants were only partially resistant, and seeds saved from these and compared with the seed obtained from the resistant or immune plants when sown resulted in poor plants, showing the characteristics of the diseased ones in root, stalk, and leaves, while the plants from the other seed, although sown on the seed beds where the disease had occurred, produced perfectly resistant individuals.

These cases are cited by the author to show the transmitting power of the seed of tobacco from self-fertilized flowers and to point out its practical importance.

Experiments in growing Cuban seed tobacco in Texas, G. T. McNESS and W. M. HINSON (*U. S. Dept. Agr., Bur. Soils Bul. 27, pp. 44*).—The history of experiments in growing Cuban seed tobacco in Texas is given, the relation of climate and

soil to this industry is discussed, and the results of experiments during 1902, 1903, and 1904 are reported.

The temperature and precipitation for 6 months of the growing season in eastern Texas and Havana, Cuba, are compared, the averages showing a close correspondence for Palestine and Nacogdoches, Texas, with those for Havana. The monthly differences show greater variations, the temperature at Havana varying only about 8° F., while in Texas the variation is 15°. The rainfall at Havana was much heavier during the first 2 months of the period and very much less the third month than in Texas, while for the remainder of the period the differences were not so great. The mean range of humidity is about the same in both regions, but at Havana the relative humidity appears higher for a longer period during the 24 hours than at Palestine, Texas.

The soils used in these experiments were the Orangeburg fine sandy loam and the Orangeburg clay. The Orangeburg fine sandy loam is described as a compact red sandy loam containing considerable silt, with an average depth of about 12 in., and the subsoil a heavy sandy clay reaching a depth of 3 ft. or more. Both the soil and subsoil contain rounded iron concretions about one-quarter of an inch in diameter. The Orangeburg clay, which differs from the fine sandy loam in having a much lighter soil over the red clay subsoil, is described as being from 5 to 9 in. deep, of a dark-red color, and ranging in texture from a heavy sandy loam to a clay loam, with a subsoil of stiff dark-red clay, generally reaching to considerable depths.

Mechanical analyses of both soils and the content of soluble salts in the soil and subsoil are given in tables. It is stated that both soils contain enough potash salts to make them desirable for tobacco, and that the chemical analyses of the two compare favorably with those of the tobacco soils of Cuba, especially with the red soils in the Partidos district.

In 1903 work was conducted on 4 different fields representing the 2 Orangeburg soils. The lighter soils received about 15 loads of well-rotted manure and the heavier soils 20 loads per acre, the manure being plowed under and allowed to decay some time before planting. The plants were set 12 and 14 in. apart in 3 ft. rows. The crops obtained showed a very wide range in yield, believed to be due to differences in the local weather conditions, in the type of soil, and in the amount of fertilizer used.

The tobacco after being thoroughly fermented was examined and graded early in January, 1904, but at this time from 72 to 84 per cent of the crop classified as of good aroma was insufficiently aged, while only 10 to 11 per cent was judged a filler of good aroma with sufficient age. This tobacco was packed and baled and put on the market to determine its commercial value. The firms purchasing it seemed to regard it as satisfactory, although some considered it lacking in aroma and smoothness as compared with the Cuban leaf. Nearly all agreed that the leaf was the best domestic filler they had ever tested, but in the opinion of one firm the quality of the leaf was not as good as the tobacco now being grown in Pennsylvania. The prices received ranged from 28 to 40 cts. a pound.

These experiments were continued in 1904 on 4 different fields, the methods of culture, curing, etc., being quite fully described. The cost of production on the fields varied from 19.3 cts. to 26.4 cts. per pound. As in the previous year, a wide range in the rates of yield was shown. The total yield from the entire area, 8¾ acres, was 5,461 lbs., or 624.1 lbs. per acre, with an average cost of production of 21.6 cts. per pound. "It is believed that the farmer having all the facilities on his plantation can grow this tobacco at a cost not exceeding 10 cts. a pound."

In 1905 this type of tobacco was planted on about 150 acres of Orangeburg soils in three counties, and a tobacco firm has agreed to purchase the barn-cured product at a remunerative price. "It therefore appears that in the course of a few years, if the

industry be conducted on a conservative basis, the growing and packing of tobacco can become an important industry of east Texas."

Experiments in breeding tobacco, E. H. Jenkins (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. 449–456, pl. 1*).—In 1903, 12 different types or strains of tobacco, including 7 of the Sumatra type, 2 of the Cuban, and 1 each of Connecticut Broadleaf, Connecticut Havana, and White Burley were grown, and small quantities of seed from individual plants were selected as being the very best in the plats and exclusively self-fertilized. From this set 4 strains of the Sumatra type, 1 of the Cuban, and 1 each of the Connecticut Broadleaf, Connecticut Havana, and White Burley were obtained and are here briefly described. As in the previous year, seed from selected and exclusively self-fertilized plants was secured for future work.

The general result of the season's work indicates that the characters of the particularly selected mother plant were transmitted to each one of the offspring with a remarkable degree of uniformity. The author reports that this was the first time since the experiments with Sumatra were begun, in 1900, that plats were secured in which the plants were uniform in size and in the number and shape of the leaves. The effect of cross-fertilization and self-fertilization in tobacco is discussed and an article giving one of the very earliest descriptions and pictures of the tobacco plant, written soon after its introduction into the Old World from the West Indies, is reproduced.

A new and valuable cover crop for tobacco fields, A. D. Shamel (*Connecticut State Sta. Bul. 149, pp. 7, fig. 1*).—The need of a suitable cover crop for tobacco fields is pointed out, and hairy vetch, sand vetch, or Russian vetch (*Vicia villosa*) is described with special reference to its use for this purpose. Directions for planting the crop are given, and its value for forage or green manure is also briefly noted.

In October of 1904 several tobacco fields were sown to Russian vetch either with rye or alone. In some instances the soil preparation consisted of plowing and harrowing, while in others the seed was sown on the unprepared ground and disked in with an ordinary disk or wheel harrow. Both inoculated and uninoculated seed was used.

Although the seeding was thinner than desirable, a good stand was obtained and the crop wintered better than the rye which was sown with it, the vetch surviving in spots where the rye completely winterkilled The roots of plants from inoculated seed bore many tubercles, while on the plants from the uninoculated seed they were less numerous and the plants much less vigorous. When the crop was plowed under in May the plants were from 4 to 8 in. high

Universal nomenclature of wheat, N. A. Cobb (*Dept. Agr. N. S. Wales, Misc. Pub. 539, pp. 75, pls. 15, figs. 74*).—This publication includes a series of papers published in the Agricultural Gazette of New South Wales and previously noted (E. S. R., 15, p. 246).

A further study of the volume, microscopic structure, and strength of the aleuron layer in wheat is reported. In this study the distribution of gluten in the ripe endosperm of typical Australian wheat was determined, and observations made on the structure of the flour cell. Directions are given for the selection of average samples, the preparation of sections of a ripe wheat grain, the demonstration of the distribution of gluten in the flour cells, and the collection of all the gluten from a single flour cell.

Spraying to kill weeds, T. D. Jarvis (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 39, 40*).—Early in July weed patches in which 28 species and 12 botanical families of plants were represented were sprayed with a solution of 9 lbs. of bluestone to 45 gal. of water. It was observed that 24 hours after spraying the effects were the same as 6 hours after the treatment. It is concluded that wild mustard is the only weed that can be destroyed by spraying with this solution. The flowers of field bindweed and white cockle, and the leaves of blue weed, bull thistle, Canada thistle, and sow thistle proved very sensitive to the spray.

HORTICULTURE.

Opportunities in agriculture (*U. S. Dept. Agr. Yearbook 1904, pp. 161–190, pls. 3*).—This subject is popularly considered from 3 different standpoints: (1) Growing Crops under Glass, by B. T. Galloway; (2) Fruit Growing, by M. B. Waite; and (3) General Farming, by W. J. Spillman.

On the subject of growing crops under glass such phases are considered as general plant growing, vegetable growing, cut-flower growing, and the growing of bedding and ornamental plants as a specialty. The business and training qualifications necessary for each of these industries, capital involved, and the profits which may reasonably be expected are considered.

Under fruit growing, special attention is called to intensive methods and the desirability of thorough cultivation and care of relatively small areas as compared with more extensive plantings. The various details of orchard management, cost of establishing an orchard, and the opportunities in intensive fruit growing are discussed. The average cost of establishing an orchard and its care for the first 5 years is placed at $100 per acre.

Under general farming special attention is called to possibilities in the milk and fancy butter trade, poultry, vegetable gardening, cheese making and live stock in the South, and seed production.

Horticultural work at the Canadian Experiment Stations, W. T. Macoun, W. S. Blair, S. A. Bedford, A. Mackay, and T. A. Sharpe (*Canada Expt. Farms Rpts. 1904, pp. 105–122, 125–128, 134, 135, 353–359, 364–370, 395–409, 435–446, 466–485, pls. 2*).—A report on the character, culture, and behavior of a large number of fruits, vegetables, and flowering plants grown at the different experimental farms in Canada from Nova Scotia to the Northwest Territories. The reports are similar in character to those of previous years (E. S. R., 16, p. 261).

The severe winter of 1903–4 killed large numbers of fruit trees in the orchards of Ontario and Quebec, which for many years previously had proved hardy. At the Central Experimental Farm 306 apple trees, including 164 varieties, were killed, all above the snow line. During the preceding 6 years 90 varieties of apples were top grafted on hardy stocks to determine whether varieties which would not succeed when grown in the ordinary way would prove satisfactory when top grafted on stocks having heavy trunks. Practically all of the varieties thus used for top grafting were killed back to the stocks.

One instance is cited in which Milwaukee and Martha were top grafted on Wealthy, each variety occupying about half the top of the tree. As a result of the severe cold Martha was entirely killed, while the Milwaukee remained alive and bore a good crop of fruit. Trees which have proved tender when tried as standards are thus shown to be also tender when grown on hardy stocks. Hardy stocks do not appear to make grafts noticeably hardier. A revised list of the winter varieties of apples recommended for the district is as follows: Scott Winter, Milwaukee, Northwestern Greening, Canada Baldwin, and Golden Russet in the more favored localities.

A further account is given by Mr. Macoun of the close-planted (10 by 10 ft. apart) Wealthy orchard set out at the Central Experimental Farm in 1896. The average profit per year per acre from this orchard from 1896 to 1904 has been $54.13, while the average profit per year per acre since the trees have been bearing well, from 1899 to 1904, has been $106.19. This system of close planting is not recommended for general adoption, but is believed worthy of trial by specialists. The 2 varieties Wealthy and Wagener are believed to be the most suitable for this close planting on account of their early bearing habits.

Experimental shipments of apples from this station to points in Ireland and Scotland were made in 1904. All the shipments were made in bushel boxes and all graded XXX. Some of the fruit was sent in cold storage, but the most of it was

not. The fruit was placed in the boxes in regular rows and tiers, with a sheet of cardboard above and below and a very little excelsior between the cardboard and the sides of the box. Apples were shipped as a rule when well colored but still hard. The varieties were Duchess, Charlamoff, Antonovka, Anis, Dudley, Winter Stripe, McMahon White, Wealthy, and Patten Greening. The varieties Charlamoff, Anis, and Winter Stripe in some shipments were wrapped in tissue paper.

In every instance the apples arrived at their destination in good condition, but owing to the unusual abundance of apples in both Ireland and England the results were not as profitable as heretofore. The apples shipped to Belfast, the agent stated, were not good enough for dessert purposes, and hence brought a low price, scarcely sufficient to pay the freight. That market, also, preferred apples in barrels instead of in boxes. Wealthy apples shipped to Dublin sold from 84 cts. to $1.08 per box. The shipment of Patten Greening and Wealthy to Glasgow brought about 68 cts. a box net.

The severe winter killed most varieties of European and Japanese plums at the station down to the snow line. Two seedlings, however, of the Red June plum originated at the experimental farm proved hardy in flower and bud and have been given the names of Togo and Oyama. Three American seedlings originated at the Central Experimental Farm have been named Gloria, Swift, and Fitzroy. All of these varieties are described, as well as some of the newer Americana varieties.

Horse beans have proved a very satisfactory cover crop in the orchards. These beans stand up during the winter and hold the snow well and in the spring are easily broken up by a disk harrow. It is believed that English horse beans and rape grown together will prove an ideal cover crop for that region. The beans furnish nitrogen and humus and hold the snow well, while the rape will cover the ground and thus protect the roots.

One of the disadvantages of hairy vetch, otherwise an excellent cover crop, is the difficulty of plowing under where it lives over the winter. The crop lived over the winter at the Central Experimental Farm and the plan was tried of cutting it and letting it lie on the ground as mulch in the same way as red clover is sometimes used. The vetch, however, was killed by the first cutting.

Further experiments were made during the summer in growing vegetables in a cheese-cloth inclosure. Radishes and cauliflowers grown inside the inclosure were again free of maggots except where the plants had been affected in the hotbed before setting out in the inclosure Both these vegetables developed satisfactorily in the inclosure. The radishes were 2 days later than those grown outside, but remained fit for use nearly a week longer inside than outside. Outside the inclosure the cauliflower was practically a failure, while inside the crop was quite satisfactory.

Lettuce was ready for use 2 days earlier inside the inclosure than outside. Beans were ready for use 1 to 2 days later inside than outside the inclosure. The yield inside the inclosure was 58 qts. and outside 53 qts. on like areas of ground. There was no apparent difference between onions grown outside and inside. The same cheese-cloth cover which was used in 1903 was again used in 1904 but tore considerably and gave trouble. The life of a cheese-cloth tent, therefore, will not exceed 2 years. The cost was 5 cts. per yard.

Nolte Earliest tomato yielded heavier than Spark Earliana, but it is not quite so smooth. Spark Earliana has proved one of the earliest ripening and most satisfactory varieties grown at the station for 5 years. A method of pruning tomatoes tried during the year has been previously noted from another source (E. S. R., 17, p. 36).

At the Nova Scotia station crimson clover has proved one of the best cover crops for use in orchards. It is sown at the rate of 20 lbs per acre. An increase of 44 bu. of green peas per acre was secured by the use of 500 lbs. of a complete commercial fertilizer at a net profit of $5.70 per acre. The Australian Brown onion is considered the best variety for the average grower.

Mr. S. A. Bedford, of the Manitoba Station, gives a list of varieties of standard apples root-grafted on *Pyrus baccata* which have been planted at the station and the effect of the winter on them. Most of the varieties were killed back more or less, but many varieties made a strong growth during the season. Plums were a heavy crop at the station. Three native varieties which fruited for the first time proved superior to anything tested as regards earliness and flavor. The fruit ripened early in August, which was fully 2 weeks sooner than fruit of any other varieties found on the farm. The plums are comparatively large, deep red in color when ripe, skin sweet and juicy with no sign of astringency, and the stone was not out of proportion to the flesh. The fruit from all 3 trees is very similar and has been given the name of Major.

Fall-sown seed of *Caragana arborescens* has given much stronger plants than spring-sown seed. Various tender species of Philadelphus have been successfully grown at the station when bent to the ground and sufficient soil thrown over the tips to hold them there during the winter. Gradus has proved the earliest large pea yet tested.

Report of the professor of horticulture, H. L. HUTT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 102–116, figs. 5*).—This report gives an outline of the horticultural work at the Ontario Agricultural College during the year, with notes on various cover crops, orchards, small fruits, vegetables, and ornamental shrubs.

The severe winter killed 10 per cent of the trees in the apple orchard, 20 per cent of those in the plum orchard, 35 per cent in the pear orchard, and 44 per cent in the cherry orchard. Twenty peach and 20 quince trees which had survived several winters were also killed.

How to make a vegetable garden, EDITH L. FULLERTON, illus. by H. B. FULLERTON (*New York: Doubleday, Page & Co., 1905, pp. XIX + 347, figs. 253*).—Popular directions for making a garden and the culture of all the usual vegetables and small fruits. The illustrations form a prominent feature of the work. A table is given showing when to plant each of 74 different vegetables, depth to plant them, distance apart, the period when the crop matures, and other information as to cultural methods.

Test of the vitality of vegetable seeds, E. H. JENKINS (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. 438–443*).—A table is given showing the results of germination tests of 415 samples of seeds representing 34 different vegetables.

The age of the samples varied from 1 to 12 years, most of them being 1 to 2 years old. They were sent in by the seedsmen or growers themselves with the understanding that the results of the test were not to be published as representing the character of their goods. Sweet corn and onion seed are grown in large amounts in the State and more tests of these varieties are annually made at the station than of all other kinds of seeds.

California-grown onion seed showed a higher percentage germination than Connecticut-grown seed, and seed less than 1 year old germinated better than older seed. The vitality of crops of onion seed for 1880 and each of the years 1894 to 1904 is tabulated and another table given showing the sprouting ability of different varieties of onion seeds and sweet corn.

Mushroom growing for amateurs, G. F. ATKINSON and R. SHORE (*New York Cornell Sta. Bul. 227, pp. 415–424, figs. 4*).—Experiments were undertaken in the culture of mushrooms to learn what success might be expected by amateur growers where no elaborate preparations were made as to special houses.

Cellars or basement rooms may be used for mushroom culture in winter provided the temperature does not go below 55° F. or rise above 65° F. They should not be grown in cellars under the living part of a house, as the fumes of manure will fill the house. They can be grown in stables which are not too cold.

In the station experiments they were grown in part in boxes under benches in the greenhouse, where the temperature during the winter was about 55° F. at night and

60 to 65° F. during the day, and in part under a bench in a basement. The boxes used were 3x3.5 ft. wide and 1 ft. deep. The bed under the bench in the basement was made by placing a plank against the legs of the bench and filling the space between that and the wall with well-packed manure. The boxes and bed together contained about 90 sq. ft. of surface and yielded at the rate of about 2 lbs. of mushrooms per square foot. The manure for the boxes and bed was composted October 31 and was ready for putting in the beds November 9.

The beds were spawned November 23 and covered over with dirt December 1 and 2. The first mushrooms were picked January 1, or about 5 weeks from the time the beds were spawned. The regular picking began a week later. The spawn in a small part of the bed did not produce mushrooms until about 2 months after spawning. When the crop was at its best 4 to 8 lbs. of mushrooms were collected at each picking.

Detailed directions are given for the making of mushroom beds in cellars, for the preparation of the manure and packing into the beds, and for the buying and insertion of the spawn in the prepared beds, with general notes on the growth of mushrooms, picking mushrooms, and the enemies affecting mushrooms. Illustrations are given of the varieties Alaska, Columbia, and Bohemia, as grown under the different conditions in the experiment.

The orchard and fruit garden, E. P. POWELL (*New York: McClure, Phillips & Co., 1905, pp. XV+322, pls. 24*).—Popular directions are given for the culture of orchard and small fruits, including citrus fruits, figs, dates, olives, pineapples, bananas and other tropical fruits, and nuts. In the concluding part of the work chapters are given on wind-breaks, drainage, irrigation, pruning, mulching, fertilizing, cover crops, spraying, the animal friends and foes of the garden, harvesting and marketing of fruit, and plant breeding. The book is written for the practical fruit grower, and appears to be well adapted for that purpose.

Promising new fruits, W. A. TAYLOR (*U. S. Dept. Agr. Yearbook 1904, pp. 399–416, pls. 8*).—Descriptions with colored illustrations are given of a number of promising fruits and nuts. Among these are the Bloomfield and Doctor apple, Rossney pear, Millennial grape, Perfection currant, Delmas persimmon, and the following 10 varieties of pecans: Centennial, Frotscher, Jewett, Pabst, Post, Rome, Russell, San Saba, Stuart, and Van Deman.

New citrus creations of the Department of Agriculture, H. J. WEBBER and W. T. SWINGLE (*U. S. Dept. Agr. Yearbook 1904, pp. 221–240, pls. 13, figs. 2*).—In the work of the Department with citrus fruits the primary objects sought have been "(1) hardier varieties which would endure the occasional severe freezes which visit the orange sections, and, if possible, varieties sufficiently hardy to be grown farther north than the present citrus belt; (2) new fruits having the loose, easily removable rind of the mandarin and tangerine combined with the quality, flavor, and size of the ordinary sweet orange; (3) new fruits having the sprightly acid flavor of the pomelo with the bitterness reduced, and the loose, easily separable rind of the mandarin and tangerine; and (4) new fruits intermediate between the pomelo and the orange which would possess desirable market qualities."

A hardier fruit has been obtained by crossing the trifoliate orange (*Citrus trifoliata*) with the sweet orange. Considerable difficulty was experienced in crossing these 2 varieties and only about 2 per cent of the flowers operated upon set fruit. Owing to the polyembryonic character of the seeds of citrus fruits considerable care was necessary in selecting the true hybrids. Of 40 hybrids of the trifoliate orange crossed with the pollen of the sweet orange, 29 resembled the former in habit and foliage characters while 11 were intermediate in these characters. From these crosses 2 fruits have been developed which are of considerable promise.

These fruits are about midway in character between the 2 parents and are neither sweet oranges, trifoliate oranges, nor lemons, and have therefore been grouped under

the class name of "citranges." They have been given the variety names of Rusk and Willits. They are described in detail and illustrated with colored drawings.

The Rusk is from $1\frac{1}{2}$ to 2 in. in diameter and $1\frac{1}{4}$ to $1\frac{5}{8}$ in. high. It is considered too sour to be eaten out of hand but is very palatable with sugar. It has a bitter flavor and is considered valuable for making "citrangeade," similar to lemonade, or for use as a breakfast fruit. It may also be used for pies, preserves, marmalades, and general culinary purposes. The Willits, while similar in general appearance, possesses a distinct flavor from that of the Rusk, having more nearly the character and flavor of the lemon.

These fruits have withstood a temperature of from 15 to 18° F. above zero and in one instance a minimum temperature of 6° without injury. It is believed that they may be grown without protection throughout South Carolina, Georgia, Alabama, Mississippi, Louisiana, Arkansas, parts of Tennessee and Texas, also parts of Washington, Oregon, northern California, Arizona, and possibly New Mexico, and will prove of value mainly as a home fruit for cultivation throughout the Southern States where the sweet orange, the lemon, and lime can not be grown.

The tangelo is a name given to a new class of loose-skinned citrus fruits obtained by crossing tangerines with the pomelo. A variety originated in this group, called the Sampson, is described and illustrated. The tangelo is about midway in size between its 2 parents. It has a sprightly acid flavor but is rather sweeter than the pomelo with a slightly bitter taste. "Its most pronounced characters, however, are the looseness of the rind and the ease with which the segments can be separated." The flavor is considered excellent, and it is believed it will become very popular as a breakfast fruit.

Two new tangerine oranges have been obtained by crossing the Dancey tangerine with pollen of the Parson Brown orange. The fruits obtained from these crosses differ from other varieties of tangerines primarily in being larger, earlier, and more highly flavored. The variety given the name of Weshart uniformly colored up and ripened about 2 weeks earlier than the Dancey tangerine. The fruit of the variety given the name of Trimble is slightly larger than the Weshart tangerine but not quite equal to it in flavor. The rough, bumpy appearance of the Trimble serves to distinguish it from other tangerines.

It is believed that these 2 tangerines will prove superior to the Dancey in nearly every respect. They are recommended for culture wherever tangerines are now grown. Neither these tangerines nor the tangelo previously described are more hardy than the ordinary pomelo and tangerine and therefore can be grown only in the districts where such fruits succeed. Detailed descriptions are given of the fruit and trees of both these new varieties of tangerines.

An apple orchard survey of Wayne County, New York. I, The apple industry, G. F. WARREN (*New York Cornell Sta. Bul. 226, pp. 239-362, pl. 1, figs. 62*).—This survey was undertaken under the direction of John Craig. In the survey every orchard in Walworth Township as large as 1 acre in extent was personally inspected. In the remaining townships of the county only orchards of 5 acres in extent or over were visited. Wayne County is one of the leading counties in fruit production in the State.

The data secured in this survey cover such matters as methods of tillage, the use of fertilizers, pruning, spraying, number of trees per acre, distance apart, age of the orchards, soils, drainage, elevations and exposures, whether the orchard was rented or managed by the owner, varieties of apples grown, most prevalent diseases and insect enemies, yields, markets, and prices.

In all, 574 orchards containing 3,761 acres were examined in Wayne County during the summer of 1903. The total apple area in the county is about 21,000 acres or [illegible] per cent of the improved farm land. The most prominent varieties grown are Bald-

win and Greening followed by Roxbury Russet, King, Northern Spy, and Twenty Ounce. From 20 to 25 per cent of the orchards are rented. The average yield of rented orchards for 4 years was 174 bu. per acre and from orchards managed by the owner 210 bu. More attention is paid to orchard culture than formerly, 14 per cent having been distinctly renovated during the past 10 years.

Relative to tillage and yield, 44 per cent of the orchards have been in sod at least 5 years, 20 per cent have been tilled 5 years or more, and 36 per cent have been tilled part of the time. In 1903, 30 per cent of the orchards were tilled. The average yields for 4 years in the orchards thus differently managed were as follows: Tilled for preceding 5 years or more, 266 bu. per acre; tilled most years, 229 bu.; in sod most years, 202 bu.; in sod at least 5 years, 148 bu. It is thus seen that the tilled orchards have given an average yield 80 per cent higher than orchards regularly in sod.

Not all this difference, however, is due to tillage, since the men who till the orchards usually also give better attention to manuring, spraying, and pruning. Taking these factors into account it was found that the increase in yield, due to tillage alone, was about 35 per cent. A large number of the orchards in sod were pastured with various kinds of stock. Orchards pastured with hogs or sheep gave better results than those pastured with cattle or horses. A few orchards in sod were found which were among the best producers.

About one-third of the orchards examined received no fertilizers whatever. The other two-thirds received more or less manure. Commercial fertilizers were used in only about 12 per cent of the orchards. The average yield for 2 years in fertilized orchards was 257 bu. per acre and in unfertilized 202 bu.

Buckwheat is the cover crop most commonly grown. Bad pruning was frequently observed. In 16 per cent of the orchards stubs from 2 to 12 in. long were found. Thirty-three per cent of the orchards was seldom or never sprayed. Forty-one per cent was sprayed in 1903. The sprayed orchards in 1903 averaged 27 bu. more per acre than the unsprayed orchards. Damage from insects and fungus diseases was small during the year, and in some instances only one spraying was given.

In 43 per cent of the mature orchards the trees were 30 by 30 or less ft. apart. The average yield for 4 years where the trees were 30 by 30 ft. apart was 186 bu. When 31 by 31 ft. to 35 by 35 ft. apart the average yield was 222 bu., and when 36 by 36 ft. to 40 by 40 ft. apart the average yield was 229 bu. per acre. Trees were found to reach their maximum yield in Wayne County 44 years after planting.

Eight per cent of the orchards examined needed drainage throughout, 30 per cent needed drainage in part. Fifty-four orchards in Walworth Township which needed drainage yielded 42 bu. per acre less fruit than the average of the township. Good crops of apples were found on many different types of soils, but loam soils are considered best. The kind of treatment the orchard receives is believed to be of far more importance than the kind of soil. Elevation above the surrounding country did not appear to have any marked effect on the yield. Easterly slopes gave considerably better yields than westerly slopes, which it is thought may be due to the strong west winds. Scab fungus and the codling moth are the most serious enemies.

About 75 per cent of the apple crop in Wayne County is used for evaporating. In this work some growers pick off the best apples to barrel, but generally all the apples are shaken from the tree. The average yields per acre for mature orchards in 1900 was 252 bu.; 1901, 34 bu.; and 1902, 222 bu. The gross average incomes for these same orchards were $37.80 in 1900, $14.28 in 1901, and $48.18 in 1902. Mr. Christian Bues gives a detailed account of the cost of renovating an apple orchard in Western New York during the years 1896-1904, with an account of the returns received. It was about 5 years after the work of renovation commenced before the orchard began to produce paying crops.

Besides the statistical matter given the bulletin contains a large amount of useful information relative to the best methods of cultivation, pruning, spraying, etc.

The breeding of crossbred apples for the Canadian Northwest, W. SAUNDERS (*Canada Expt. Farms Rpts. 1904, pp. 6–11, pls. 2*).—All of the improved American varieties of apples have failed or have been killed by cold when grown in the Canadian Northwest, more especially at the experiment stations at Brandon, Manitoba, and Indian Head, Northwest Territories.

The Siberian crab (*Pyrus baccata*) has proved entirely hardy at both these stations during a trial of 14 or 15 years, and has fruited abundantly. Its fruit is very small and suited only for jelly. The flowers have been cross-fertilized with pollen from many of the hardiest and best sorts of apples grown in Ontario, and from the seed thus obtained a number of seedlings have been grown, which have produced fruit much larger than the crab and greatly improved in quality. Many of these seedlings fruited the fourth year from seed.

Root grafts of some of the more promising sorts have been made and have shown no indications of tenderness even when planted in exposed situations. Some partial failures have occurred in grafting on *P. baccata*. Budding gives better results and forms a better union with the stock, and also admits of the trees being multiplied more rapidly.

Other crabs which are being used are *P. prunifolia* and the wild apple of Europe (*P. malus*). These are likewise crossed with pollen from the hardiest of our improved sorts, and a number of promising seedlings have been obtained. Both of these species have proved hardy for several winters at Brandon and Indian Head.

Some of the best crosses produced on *P. baccata* and *P. prunifolia* have been recrossed, thus introducing a second quota of the blood of the larger and better apples, with the hope of improving the size and quality of the fruit.

About 20 of the most promising seedlings obtained by crossbreeding are described. A considerable amount of stock of these sorts has been distributed in different districts of the Northwest for further testing.

Apple culture, H. L. HUTT (*Ontario Agr. Col. and Expt. Farm Bul. 144, pp. 37, figs. 7*).—Popular directions for the planting and management of apple orchards, including a paper by W. Lochhead on insects injurious to the apple.

Observations on the fertilization of peach orchards, E. H. JENKINS (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. 444–447*).—An experiment on the fertilization of peach orchards, which was begun at the station in 1896 and has been continued each year since (E. S. R., 16, p. 52).

Plat A has received annually 65 lbs. of muriate of potash and 160 lbs. of acid phosphate; plat B these same fertilizers and in addition 170 lbs. of cotton-seed meal; plat C, 65 lbs. of muriate of potash and 160 lbs. of acid phosphate; plat D, 130 lbs. muriate of potash and 160 lbs. of acid phosphate; plat E, 260 lbs. of muriate of potash and 160 lbs. of acid phosphate; and plat F, 260 lbs. of high-grade sulphate of potash and 160 lbs. of acid phosphate.

The number of trees that have died during each year since the orchard was set out and the crops produced in each of the years 1899 to 1904 are given, but conclusions relative to results obtained are reserved until further data have been accumulated.

The shipping of fruit to Winnipeg by freight, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 25–30*).—Much of the data given in this article has been abstracted from another source (E. S. R., 16, p. 876).

Some notes are given on the dimensions of fruit packages in relation to cooling. Fruits which ripen quickly must be cooled to a temperature of 40° or lower soon after picking if they are to be preserved in storage for any length of time. A few hours' delay in cooling down to this temperature greatly decreases their length of life.

In the experiment reported 4 packages were filled with apples and long thermometers inserted so that the bulb would come in the center of the package. The packages

were then headed and kept in a room for a week, until they attained a uniform temperature of 64° F. They were then transferred to a room in the warehouse which was kept at a temperature of 32 to 34°. The packages were an ordinary large apple barrel, a bushel box 10 by 11 by 20 in. with close joints practically air-tight, a Georgia peach carrier 10 by 11 by 20 in. with open spaces at sides and the fruit then packed in 6 baskets with air spaces between the baskets, and a half-bushel box 5 by 11 by 20 in. with open spaces at sides, bottom, and top.

Within 9½ hours after the packages had been placed in the cold-storage house the half-bushel crate registered 40°. The Georgia crate with open sides and open packing had cooled to 43° within the same time. Within 22 hours the half-bushel had cooled to 35°, the Georgia crate to 35°, the bushel to 39°, and the box to 47°. It was 2 days after the commencement of the observation before the barrel had reached a temperature of 38°.

As a result of this investigation, the author states that winter apples and winter pears, so far as temperature and ripening are concerned, may be packed in barrels. For summer and early apples the bushel box should be used. For early and quickly ripening pears the bushel box is too large unless in the form of the Georgia carrier with open sides. The half-bushel box is recommended. All tender fruits should be quickly cooled after picking.

Some uses of the grapevine and its fruit, G. C. HUSMANN (*U. S. Dept. Agr. Yearbook 1904, pp. 363–380, pls. 6, figs. 5*).—This is a popular account of the grape industry with reference to the use of the fruit for food, wine, raisins, unfermented grape juice, brandy, vinegar, preserves, tartaric acid, oil, etc., and of the vine for ornamental purposes.

The average annual production of wine in the United States during the past 10 years has been 25,500,000 gal. and of raisins 89,500,000 lbs. The average annual shipment of California-grown grapes to States farther east is placed at 25,156,000 lbs. About 50 per cent of the grape crop in California is made into wine, 35 per cent into raisins, and 15 per cent shipped as fresh grapes.

California is the State of largest production, having over 90,000,000 vines. New York stands second with a little over 29,000,000, and Ohio third with nearly 14,000,000 vines. New York State leads in the production of grapes of American varieties, since practically the whole of the California output is of European sorts. In the Chautauqua grape district of New York more unfermented grape juice is produced than in all the rest of the country combined, the product in 1904 reaching 605,000 gal. New York leads all the States in the production of sparkling wine.

Methods of making red and white wines are discussed, and methods of manufacture of the various by-products mentioned above briefly noted, including a number of household recipes for canning grapes, making grape pickles, jelly, spiced grapes, marmalade, grape butter, junket, etc.

Grapes cultivated in tropical countries, O. LABROY (*Jour. Agr. Trop., 5 (1905), No. 46, pp. 101–106*).—An account of varieties of grapes which succeed best in several different tropical countries.

A chemical study of the tea industry in South Carolina, I, F. S. SHIVER (*South Carolina Sta. Bul. 96, pp. 32, figs. 6*).—In this bulletin a historical review is given of tea culture with statistics as regards production and consumption. The botanical characteristics of tea are considered, together with the soil and climate best suited for tea culture and methods of cultivation.

From the statistics given it appears that about 89,160,411 lbs. of tea, valued at $12,720,310, are imported each year. Ninety-two per cent of the tea imported is furnished by China and Japan. Analyses are given of the soils at Pinehurst, S. C., where about 100 acres are now planted to tea, and of the rice soils on Cooper River, S. C., where it is proposed to establish a tea plantation.

As the result of experiments at Pinehurst in tea culture on different soils, it is recommended that "level lands, thoroughly drained, porous to as great depth as possible and free from all acidity, be used for tea." Based on the analyses of the soils made it is believed that they are well adapted to tea culture as they contain considerable quantities of organic matter, nitrogen, phosphoric acid, and potash. Suggestions are given on the starting of tea plants, setting out the plantation, pruning, and care.

Report on the cocoanut industry, W. S. LYON (*Philippine Bur. Agr., 1904, pp. 88-93*).—An account of the cultural and manufacturing methods observed in the cocoanut industry in the 2 largest cocoanut-growing districts of the Philippines. Considerable space is devoted to the production of cocoanut oil and of copra.

Contribution to our knowledge of the use of the betel-nut in Dutch East India (*Bul. Kolon. Mus. Haarlem, 1905, No. 32, pp. 173, pls. 13, figs. 8*).—A series of 7 prize essays on this subject.

Propagating trailing arbutus, H. J. KOEHLER (*Amer. Florist, 24 (1905), No. 872, pp. 150, 151*).—It is stated that trailing arbutus can be easily rooted from cuttings in the greenhouse in winter. The cuttings are treated in a manner somewhat similar to that of a coniferous evergreen. They are taken preferably in November before they are severely frozen. They are put in boxes of sand and watered twice daily, and the night temperature kept about 50° F. Shade is given during the middle of the day. In about 6 weeks 75 per cent of them will be rooted and ready to pot off.

FORESTRY.

Forest planting and farm management, G. L. CLOTHIER (*U. S. Dept. Agr. Yearbook 1904, pp. 255-270, pl. 1, plans 3*).—A discussion of the relationship of forest planting to general farm management, with concrete examples taken from forest plans devised for an Ohio farm and for prairie farms in the northern and southern sections of the middle western States.

The central thought brought out in the paper is that forestry is a branch of agriculture and can be made to contribute to the welfare of the farmer when wisely planned. The plans suggested take into consideration the cropping system of the farm, protection of the farm buildings, the location of the woodland strips, the kinds of trees to be used, and the best methods of planting and arranging them.

Horticulture and forestry, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 128, pp. 278, 279, 303*).—An account of the horticulture and forestry work carried on at the Fort Hays Branch Station in 1903-4.

Observations in the vicinity of the station indicate that the honey locust is the most hardy and desirable tree in that section for planting. Of 4,000 evergreens planted in 1903, 32 per cent were alive in 1904 and made a good growth. The rather small percentage that lived is thought to be due to unfavorable conditions at planting time. The Austrian pine has proved the most hardy of the different evergreens planted. About 9 acres have been planted to oak and walnut seed.

Forest belts, W. T. MACOUN (*Canada Expt. Farms Rpts. 1904, pp. 136-139*).—The forest belt on the western boundary of the Central Experimental Farm is 165 ft. wide and that on the northern boundary 65 ft. wide. Their total length is nearly 1.75 miles. The number of trees in these belts is 23,100. The trees have been planted 5 by 5 ft., 5 by 10 ft., and 10 by 10 ft. apart, and the first plantings made in 1887.

From the standpoint of forestry, trees planted 5 by 5 ft. apart are giving the most satisfactory results. At this distance the trees are more protected from storms than those farther apart, the tops are less injured, and they are a little taller and do not have to be cultivated so long as those planted farther apart.

Until within 3 years the trees in the mixed plantation made the most satisfactory growth, and are still making better growth than some clumps composed of single

species. The rapid-growing kinds, however, in the mixed plantations are growing so fast as to overshadow some of the more valuable trees, and those which can not endure shade are being killed. Such trees as ash, butternut, black walnut, and elm, which have thin foliage, do not kill the sod underneath. It is believed the results would have been much better if other heavy-foliaged kinds, such as larch, spruce, pine, or box elder had been mixed with them.

Since 1899 other plantations with trees and shrubs have been made in which the spacing has been 2.5 ft. apart. It is too early to report upon these plantings as yet, but it is believed that 3 ft. apart would be as satisfactory or even more so than 2.5 ft. A table is given showing the growth of 20 different species of trees in the forest belt. Black walnut and butternut are making a very slow, unsatisfactory growth where planted on low sandy soil. White spruce is not doing very well on light sandy soil, nor white elm on sandy loam. All these trees have made a much better growth on other soils.

Forestry in Indiana, S. J. RECORD (*Forestry and Irrig., 11 (1905), No. 3, pp. 107-112, figs. 4*).—It appears that 13,000,000 acres, or more than one-half the State of Indiana, consists of broken waste land suitable for tree growth but worthless for agriculture.

Less than 2 per cent of the total area of the State is now covered with good timber and about 85 per cent of the lumber now used for manufacturing is brought in from other States. The large amount of nonagricultural land is well distributed over the entire State in comparatively small areas. Of the several ways in which it is possible for the State to influence matters in forestry it is believed the only method at present available is that of education and persuasion, by which the farmers can be awakened to the possibilities and advantages of forest planting for posts, fuel, and lumber.

A brief review is given of the forest legislation of Indiana. In 1903 a law was enacted which provides for the purchase by the State board of forestry of 2,000 acres of land at a cost not to exceed $8 per acre, and $1.50 is to be allowed annually to defray the expenses of management and labor. This land was purchased in Clarke County, and various experiments are under way to demonstrate methods of sylviculture, tree planting, and forest management. A nursery has been established in which seedlings will be raised for free distribution to the farmers of the State.

The Gila River Forest Reserve (*Forestry and Irrig., 11 (1905), No. 4, pp. 178, 179*).—About 3,640 sq. miles of this reserve has been examined. Of this area 71.25 per cent is covered with merchantable timber of extra quality, while 26.25 per cent is naturally timberless. The estimated amount of timber on the reserve is placed at 5,867,169,750 ft. B. M., giving an average stand of 3,532 ft. B. M. per acre over the entire timbered belt. About 57.75 per cent of the merchantable timber is yellow pine and 28.37 per cent red fir.

Progress report of forest administration in the province of Assam, E. S. CARR (*Rpt. Forest Admin. Assam, 1903-4, pp. 64, map 1*).—A detailed review of the work of the year, including an account of the timber cut, receipts, and expenses, etc.

In the work with rubber trees on the Kulsi plantation, 88 acres containing 2,361 trees yielded 2,708 lbs. of tree rubber and 1,294 lbs. of mat rubber, or an average of 45.5 lbs. per acre and 1.7 lbs. per tree. The cost of tapping was 1,264 rupees and the product brought 11,026 rupees. In the Charduar plantation of 255 acres the average yield per acre in 1903 was 21.7 lbs. or 1.4 lbs. per tree. In 1904 it was 21.79 lbs. per acre or 1.8 lbs. per tree.

Administration report of the forest department of the Madras Presidency (*Admin. Rpt. Forest Dept. Madras, 1903-4, pp. 36 + CXVIII*).—An account of the administration and management of the state forests during the year, revenue and expenditures, etc.

During the year 2,981,880 cu. ft. of timber, including sandalwood, was cut; also 17,422,741 cu. ft. of fuel and a little over 37,000,000 bamboos, while the miscellaneous receipts from grass and grazing was placed at about $500,000. The appendix is made up of tables showing the particulars regarding forests in each of the different districts of the Presidency.

Report of forest administration in the Andamans for 1903-4, B. B. OSMASTON (*Rpt. Forest Admin. Andamans, 1903-4, pp. 31*).—A report on the conditions of the public forests in the Andamans as regards improvements, plantings, and cuttings made during the year, administration, etc.

Natural reproductions of Padouk were searched for, but practically no seedlings nor saplings of this species could be found. Mangrove sowings have proved cheap as well as successful. The average cost to completely restock swampy areas, including the cost of collection of seed, etc., was about $2 per acre. The mangroves are spaced 4 by 4 ft. apart.

The determination of timber values, E. A. BRANIFF (*U. S. Dept. Agr. Yearbook 1904, pp. 453-460*).—Experiments were made to determine exactly how much more valuable a particular kind of a tree of a certain size is than another tree of the same kind but of smaller size.

The special purpose of the investigation was to secure data on the rate at which the timber value of the tree increases with its diameter growth, in consequence of the higher quality of lumber which it will yield. In order to determine this matter trees of different sizes were cut and sawed up into lumber. The exact amount of lumber of the different grades which each tree of each size made was recorded and the value of the lumber thus obtained found by using current market prices for the different grades. Tables containing these data in detail are given for yellow birch timber from trees varying in size from 13 to 31 in. in diameter. Similar data were also collected for sugar maple and beech from Adirondack hard woods and of long-leaf pine.

From the tables given it is shown that lumber from a 24-in. birch tree is worth $5.63 per 1,000 ft. more than lumber from a 13-in. tree. From a tree 31 in. in diameter the lumber is worth $8.43 per 1,000 ft. more than from a birch tree 13 in. in diameter. With the sugar maple and beech, lumber from a 24-in. tree is worth $3.13 and $1.39, respectively, more than from a tree 13 in. in diameter. With long-leaf pine there was a difference of $1.72 per 1,000 ft. in favor of a pine 24 in. in diameter as compared with a pine 14 in. in diameter. It is believed that Adirondack lumbermen may be able to figure out fairly accurately the values of their hard woods if they know the expense of stumpage, logging, and manufacture.

In the working plan for a tract at McKeever, N. Y., the average number of trees of birch, sugar maple, and beech of 17 in. in diameter, etc., was determined. Placing the cost of stumpage, logging, and manufacture as low as $10.50 on 17-in. trees, it was estimated that there would be a profit of 42 cts. per 1,000 ft. on birch and 21 cts. on maple. If all the birch and maple above 17 in. in diameter were cut out the profits would be $11.32 per acre and the average profit per 1,000 ft. would be $4.15 from birch and $1.49 from maple. It was found that when the smaller trees were taken the profits per acre were increased but the profits per 1,000 ft. decreased.

The profits per acre when the expenses of lumbering were $10.50, $10.75, etc., up to $12.75 per 1,000 ft. were calculated for tracts in the Adirondacks, the results of which do not encourage indiscriminate cutting of hard woods in the Adirondacks, but on the other hand furnish strong arguments against careless lumbering. It is believed that the expenses of lumbering in the Adirondacks are so high that it will not pay to cut any but the larger trees. The figures obtained "prove that the lumberman who would make the highest profits out of the Adirondack hard woods must cut within certain diameter limits and leave, in most cases, a considerable stand of timber uncut."

The red gum, A. K. CHITTENDEN (*U. S. Dept. Agr., Bur. Forestry Bul. 58, pp. 9-39, 55, 56, pls. 6, map 1*).—The increased price of cottonwood and yellow poplar has gradually brought the red gum into the market.

Many of the heretofore objectionable features of this wood have been overcome by improved methods of handling, and the gum now occupies a recognized rank as a commercial wood. The red gum (*Liquidambar styraciflua*) grows in the hard wood bottom lands of the South in mixtures with ash, cottonwood, oak, etc. Other important gums which grow in the same region are the tupelo or bay poplar (*Nyssa aquatica*), and the black gum (*N. sylvatica*). The latter is not cut as mill timber.

The author made a study of the red gum as it is found in the Mississippi Valley and along the Atlantic coast. The characteristics of the tree as regards form, tolerance of shade, soil and moisture requirements, reproduction, second growth, rate of growth, etc., were investigated, together with stumpage value, lumbering methods, milling, market and uses of timber, properties of the wood, prices of lumber, methods of seasoning, and of forest management. Some attention was also paid to the lumber manufacture and uses of tupelo gum.

The red gum is intolerant of shade. It reproduces from both seeds and sprouts. Seed crops are borne when the trees reach 25 to 30 years of age and they may continue in bearing up to the age of 150 years. Trees over 50 years old seldom sprout. The stumpage value of young timber ranges from 50 cts. to $1.50 per 1,000 ft. B. M. Logs delivered at the mill bring $5 to $7 per 1,000 ft. B. M. The green logs will not float and since the waterways form the cheapest method of transportation, the method of lumbering now generally followed in the South is to cut the trees without girdling in the fall, from September to January or February, when high water sets in. They are then floated down on rafts with cypress, ash, or cottonwood, to keep them from sinking. The work is simplified where railway logging can be practiced.

Red gum is now used for practically all purposes for which poplar and cottonwood have been used heretofore. The best grade heartwood is largely exported, though some is used for inside finish in this country. Of that exported 75 per cent goes to England, France, and Germany for the manufacture of furniture and for inside finishing, etc. Common and clear sapwood goes into cheap furniture, desks, boxes, etc. The poorer stock goes into boxes, barrels, and the like.

About 60 per cent of the stock from the tree is of sap grade. This is largely used for boxes. From 40,000,000 to 60,000,000 ft. B. M. red gum is now used in this country annually for the manufacture of furniture. About 18,000,000 ft. was used in 1903 for flooring. Large amounts are used in the manufacture of slack barrels. For this purpose it must be steamed more than cottonwood or elm to prevent breakage. Other uses are for wagon-box boards, paving blocks, handles for tools, etc.

The wood is not strong enough for construction purposes. The chief objection to it is its strong tendency to warp and twist. This is largely overcome by proper methods of seasoning, which involve piling it in the yards so as to permit a free circulation of air under and through the piles. Gum boards may be successfully kiln-dried. Boards over 2 in. thick, however, are apt to caseharden.

A number of tables are given showing the rate of growth of red gum in Missouri and South Carolina, and the average stand in native and second growth forests. The rate of growth is slower in the Mississippi Valley but the trees reach there their greatest development The more rapid growth of the trees along the Atlantic results in a larger proportion of sapwood.

Tupelo gum is at present of great commercial importance only in Alabama. With this gum there is no distinction in color between heartwood and sapwood. It is generally sold in the market as bay poplar. It possesses about the same weight and strength as red gum, but is tougher and more perishable when exposed. The wood is used for furniture drawers and backs, panelwork, inside finish, and especially for

boxes. It is also largely used for moldings, wagon boxes, etc., but is not durable enough for flooring.

"Like red gum, tupelo is easily glued, painted or varnished, and absorbs little of the material. In this respect it is better than yellow poplar and much better than cottonwood." Detailed directions are given for the management of gum forests in the South, and a map given showing the distribution of red gum.

The mechanical properties of red gum wood, W. K. Hatt (*U. S. Dept. Agr., Bur. Forestry Bul. 58, pp. 5, 40–56, figs. 7*).—Tests to determine the strength of red gum timber were made at the timber-testing station of the Bureau of Forestry at Purdue University, the results of which are given in detail in tables and discussed. The tables show the comparative strength of green wood of red gum and loblolly pine, of gum from Alabama and Missouri, of heartwood and sapwood, etc.

As a stock for carriages, the tests show that red gum can be bent into shape without difficulty, that it will take a fine finish, and when properly selected will hold its shape after being bent. The best grades of red gum, however, appear to be inferior in strength to even the poorer grades of wood, such as hickory. Its use, therefore, as carriage stock should be confined to those parts of the vehicles that do not have to stand heavy loads and shocks.

The average weight of the green wood from Alabama was 49.2 lbs. per cubic foot, the maximum being 66 lbs. and the minimum 38.8 lbs. With 15 per cent of moisture the weight is about 32.4 lbs. per cubic foot and this may be taken as the weight of the wood when thoroughly air dried. The article includes an illustrated account, by H. D. Tiemann, of the microscopic structure of red gum wood.

A new species of juniper for Texas, G. B. Sudworth (*Forestry and Irrig., 11 (1905), No. 5, pp. 203–206, figs. 4*).—A new species of juniper has been discovered in Texas. The tree is 10 to 20 ft. high and has numerous stems 3 to 5 in. in diameter, which form a more or less dense clump. It has been named *Juniperus pinchoti*.

The wood has distinct narrow rings. The sapwood is nearly white and the heartwood light brown with a pale reddish tinge. It is only moderately durable in contact with the soil. One of its valuable characteristics is its persistent sprouting after fires. The wood is used locally for fuel and fence posts.

Attitude of lumbermen toward forest fires, E. A. Sterling (*U. S. Dept. Agr. Yearbook 1904, pp. 133–140, pls. 3*).—Some estimates are given on losses from fire and conditions which affect them, with some suggestions in regard to the control of fires.

The average annual loss from forest fires is stated to be about $25,000,000. In the Washington and Oregon fires of 1902 there was a loss of $12,000,000 worth of forest property in 9 days. In New York State in the spring of 1903 the direct loss from fires in the Adirondacks was $3,500,000 in addition to a known expense for fire fighting of $175,000.

While these losses are large, there are certain secondary losses of equal importance which are not generally considered by the public. These are the effect of fires on forest reproduction and water conservation. The greatest losses from fire occur on the Pacific Coast and the least in the southern hard woods.

Investigations by the Bureau of Forestry in one instance showed that in a turpentine orchard of Florida longleaf pine, which had been abandoned for 5 years, 33 per cent of the trees above 1 in. in diameter were dead or down, mainly as a result of fire. Practically all the boxed trees were burned, while of the unboxed trees 82 per cent were standing and sound. The "long butting" necessitated by the burns in the base logs of one firm operating in the Sierra forests amounted to 4.5 per cent of the total cut, which was a direct loss.

The general attitude of lumbermen toward forest fires is stated to be one of hopelessness, coupled in a measure with indifference. Forest fires are regarded as inevitable, and heretofore organized effort to prevent and control fires has not been practicable from a financial standpoint.

Practical results of the cup and gutter system of turpentining, C. H. Herty (*U. S. Dept. Agr., Bur. Forestry Circ. 34, pp. 7, figs. 5*).—The cup and gutter system of collecting crude turpentine was described at length in an earlier publication of the Bureau (E. S. R., 15, p. 46).

Since the publication of that bulletin further practical experiments in the use of this system have been carried out, and the present circular covers this work, together with improvements which have been made and an account of the defects in the system which have been discovered during the past 3 years.

The plat of timber described in the bulletin previously referred to as a "first-year crop" has been worked 2 more years as a "second-year crop" and as a "third-year crop." The results show that where the cup and gutter system was used the trees yielded $1,284.04 per crop, or over 30 per cent more than trees boxed in the usual manner.

A study has also been made of the relative condition of the trees on the cupped and boxed areas. During the period of 3 years 78 trees on the boxed area have blown down and 217 died. On the cupped area 44 trees have blown down and 150 died. Only 8 of the 44 cupped trees were blown down because of being turpentined, while the fall of 59 of the 78 trees blown down on the boxed half was due to boxing.

The productive surface lost from all causes averaged from 30 to 50 per cent more on boxed trees than on cupped trees. Much the greater part of this loss in both cases was due to "dry face" and the rate of increase in dry face after the first year was greater in the cupped than in the boxed trees and was thought to be due to the higher number of faces per tree on the cupped half.

Improvements have been made in the cups used for catching the resin. They are now made by machinery, with a stiffer, much drier clay, which prevents the seepage of resin. With experience dippers are able to collect more gum per day from the cups than from boxes. Another improvement is the use of the broadax for facing. For this purpose the usual setting of the broadax on the handle is reversed, so that in hewing the beveled side is next to the tree.

Another improvement is to have one man make both incisions for the gutters instead of employing right-handed and left-handed axmen for making the two. An instance is cited in which one laborer prepared 1,700 faces in one day and the work was well done. Zinc nails have been substituted for iron nails for hanging the cups. These are much softer than the iron nails and do not injure the saws when the trees are afterwards made into lumber.

Experimental tapping of para rubber trees at the botanic gardens, Singapore, R. Derry (*Agr. Bul. Straits and Fed. Malay States, 3 (1904), Nos. 9, pp. 339-379; 11, pp. 442-463*).—Tabular data are given on the results secured in an extensive series of experiments in tapping para rubber trees, which were planted in 1886 to 1888 and which have an average girth of 2.5 to 4.5 ft. at 3 ft. from the ground.

Better results have been secured from morning tapping than from evening tapping, although the evening work commenced as late in the day as possible. It is believed that the flow of latex depends entirely upon the pressure of water within the tree and this is affected to some extent by the contraction and expansion of the tree. It has been noted that a tree 3 ft. in girth at 3 ft. from the ground which measured exactly 3 ft. at 6 a. m. would by afternoon on bright days contract a maximum of 0.5 in. and by 6 p. m. or soon afterwards expand to the early morning measurement.

On wet days also there was considerable expansion in the tree and the flow of the latex was considerably increased, but contained an unusually high percentage of water. In wet weather it seems best to tap some hours after a storm. It has been found that latex from a big tree produces a much thicker biscuit of prepared rubber than the same amount of latex from a small tree, irrespective of age.

Experiments in tapping by the herring-bone method confirm in general the opinion as to the advantage of alternate over daily tapping.

Federal and State forest laws, G. W. WOODRUFF (*U. S. Dept. Agr., Bur. Forestry Bul. 57, pp. 259*).—This is a compilation of the various Federal and State forest laws, which has been prepared to supply the needs of the Bureau of Forestry in various matters relating to the management of forest reserves, etc., and also to supply information to private individuals. The laws are for the most part printed verbatim, except where they have been amended by later acts, or where the law is an unimportant one or but slightly connected with forest questions. In addition some important court decisions are cited, although no attempt is made to include any considerable portion of the court rulings under the laws.

The compilation is arranged according to topics, chapters being devoted to constitutional provisions, in which it is shown that Colorado, Nebraska, New York, and Utah have constitutional provisions relating to forestry; the administration and use of timberland and forest reserves; forest trespass; forest fires; bounties, tax rebates, and tax exemptions; and statutes relating to investigation, education, and public observance.

In appendixes data are given relative to the location, extent, and date of establishment of Federal forest reserves, national parks, military wood and timber reservations, and the various dates observed as Arbor Day in the several States and Territories.

Forest legislation in the Northwest (*Forestry and Irrig., 11 (1905), No. 5, pp. 231–234*).—An account of the forest legislation in Washington, Oregon, and Idaho in 1905, the greater portion of which relates to the protection of forests from fire.

Arboretum and botanic garden, W. T. MACOUN (*Canada Expt. Farms Rpts. 1904, pp. 140, 141*).—A list is given of the genera of trees and shrubs in the arboretum, with the number of species of each genus alive in the autumn of 1904.

DISEASES OF PLANTS.

Notes on fungus diseases for 1904, G. P. CLINTON (*Connecticut State Sta. Rpt. 1904, pt. 4, pp. 311–328, pls. 11*).—In a previous report (E. S. R., 16, p. 62) the author gave notes on all the fungus and bacterial diseases and physiological troubles which had been observed on cultivated plants in Connecticut. In the present report notes are given on those which were prominent during the year or which were observed for the first time. The arrangement is alphabetical by host plants.

Among the diseases and fungi which are reported upon for the first time, the occurrence of the æcidial stage of the asparagus rust is noted. The presence of the rust parasite, *Darluca filum*, is mentioned, and the same fungus is said to attack the carnation rust and the blue-grass rust. The occurrence of the downy mildew, *Peronospora parasitica*, on cabbage is noted; and in a discussion of the brown rot of cherries, caused by *Sclerotinia fructigena*, the author states that from his observations the fungus apparently spreads each spring either from the mummied fruit or infected branches, and does not travel down the diseased pedicles and from these infest the fruit spurs.

The powdery mildew of grapes is said to have been exceedingly troublesome, particularly to thin-skinned and white varieties. Notes are given on a bacterial disease of mulberry, which is reported for the first time in the State, causing more or less injury to young trees in the nursery. This disease, which is due to *Bacillus cubonianus*, destroys the twigs, and frequently the whole tree becomes stunted and yellowish in appearance. Thorough pruning of the trees in the winter time is recommended as probably the best treatment. The effect of frost injury on peaches is described.

An account is given of a disease of potatoes, which is probably of bacterial origin, and the possible relationship between this disease and the soft rot of the tubers is discussed. Mention is made of the black spot, or canker, of tobacco, and the must, which is of fungus or bacterial nature, both diseases occurring in the curing house.

Insects and fungus diseases, W. LOCHHEAD (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 40-49, figs. 5*).—After discussing fungi as a cause of plant diseases, their methods of growth, infection, and control, the author gives keys for the recognition of the diseases of apples, peaches, raspberries, gooseberries, currants, grapes, etc.

Report of the department of bacteriology, F. C. HARRISON (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 117-128, figs. 6*).—A report is given of the work carried on in the bacteriological laboratory during the season, particular attention being given to the preparation of nitrogen cultures for different leguminous plants, and investigations on the bacterial diseases of cucumbers, cabbage, and beans, and fire blight.

In discussing the cucumber wilt, the author describes the appearance of the plants affected by *Bacillus tracheiphilus*, and gives popular directions for the recognition of the disease. Where the disease is suspected it is suggested that a wilted vine be broken and if the juice is slimy it is safe to conclude that the wilt disease is present. If this test is not satisfactory, the transfer into young fruits of juice from wilted vines is suggested, after which the inoculated fruits are placed in a vessel and kept slightly moist for 4 or 5 days. If the bacillus is present at the end of this time there will appear a white, viscid, bead-like drop of bacterial growth exuding from the punctures made by the transfer needle.

If symptoms of disease develop in the inoculated fruit it is recommended that all wilted vines be pulled up and burned; and to prevent further spread, measures should be taken to combat the squash bug and the striped cucumber beetles, as it has been found that these insects carry the organisms from diseased to healthy plants.

Notes are given on the black rot of cabbage due to *Pseudomonas campestris*, which has caused considerable injury to cabbage and cauliflower and is also reported as attacking Swedish turnips. More extended notes have been given of the other bacterial diseases mentioned in Bulletins 136 and 137 of the agricultural college (E. S. R., 16, pp. 477, 480).

A review is given of the experimental work that has been carried on in the bacteriological department from 1895 to 1903, with a list of publications.

Annual report of botanist, C. A. BARBER (*Rpt. Dept. Agr. Madras, 1903-4, pp. 10-13*).—A detailed report is made of the various lines of work carried on by the botanist during the year 1903-4.

Among the more important investigations from an economic standpoint are notes on a red spot disease of sorghum leaves, which has been identified as due to the fungus *Colletotrichum lineola*.

Various diseases of other economic plants are briefly noted, particular attention being given to diseases of the black pepper, the most of which are of fungus nature. One disease in particular is proving very destructive, and it has been attributed to attacks of *Nectria* sp. as well as the root fungus *Rosellinia necatrix*. A careful investigation has led the author to the conclusion that the Nectria is saprophytic and not the cause of the disease, and in no case was he able to determine the presence of the Rosellinia in badly infected specimens in the plantation.

Notes are given of a number of economic plants which are under investigation, and a brief account is presented of the extension of the herbarium work.

Sclerotium diseases of plants (*Bd. Agr. and Fisheries [London], Leaflet 127, pp. 3, figs. 4*).—A description is given of diseases of potatoes, turnips, carrots, peas, beans, and cucumbers, as well as of a number of decorative plants propagated by bulbs.

These diseases are caused by attacks of species of Sclerotinia, which in addition to growing as parasites on living plants, can grow on decaying vegetable matter. The effect of the fungus on the different plants is briefly described, and as a preventive treatment it is suggested that all infested stems, leaves, and bulbs should be col-

lected and burned and either gas lime or quicklime applied to the land where the disease has existed.

Rusts of grain crops, J. FLETCHER (*Canada Expt. Farms Rpts. 1904, pp. 252–255*).—Popular notes are given describing the cause of the wheat rusts, and the relation of the organism to wheat and other host plants, and suggestions for preventing loss. The principal suggestion is plant breeding along the line of rust resistance.

New studies of the vegetative life of yellow grain rusts, J. ERIKSSON (*K. Landtbr. Akad. Handl. och Tidskr., 43 (1904), No. 3, pp. 234–246*).—An account of recent investigations conducted by the author on this subject. These further corroborate the views previously set forth, that the yellow grain rusts at least can live within the wheat plant from the time of germination in the fall until June the next year in the form of a mycoplasma, finally producing a protomycelium, and that from this form contagion may spread, as well as later on from uredospores. The efforts toward eradication of grain rusts must, therefore, be directed against the germ of disease in the form of mycoplasma in the plant itself, rather than against the contagion from without through spores carried about by wind and weather. Breeding experiments to secure rust-resistant varieties must therefore receive still more attention than has heretofore been the case.—F. W. WOLL.

The formalin treatment of grain smut and its application by means of Dehne's disinfection machine, S. RHODIN (*K. Landtbr. Akad. Handl. och Tidskr., 43 (1904), No. 5, pp. 368–372*).—Experiments were conducted with wheat and barley treated in the Dehne disinfection machine.

The treatment only slightly decreased the germination and the germinative energy of the seed grain, and the treated grain was free from smut in every case. The capacity of the machine is 1,000 kg. of grain per 30 minutes. In the experiments conducted by the author, 200 cc. of 40 per cent formaldehyde was dissolved in 70 liters of water for oats, and in 50 liters for other kinds of small grains.—F. W. WOLL.

Burrill's bacterial disease of broom corn, E. F. SMITH and FLORENCE HEDGES (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 502, 503*).—The occurrence of a bacterial disease of broom corn in Washington, D. C., in 1904 is noted.

The affected plants exhibited the characteristic elongating red-brown spots, followed by the death of the leaves. The disease began on the lower leaves, but by the end of September had reached the top of the plants and had destroyed all the lower leaves and badly spotted the remainder. A microscopic examination of the spots showed a bacterial focus to be present in each one. The infection was found to take place by way of the stomata and was favored by rainfall or dew.

The authors separated the organism and describe its action in various media, as well as determining a number of its cultural characteristics. Some varieties of broom corn are said to be much more susceptible to the disease than others, and it is hoped that through resistant plants the disease may be overcome.

Spraying potatoes for the prevention of blight and rot, W. T. MACOUN (*Canada Expt. Farms Rpts. 1904, pp. 131–134*).—A report is given on comparative tests on different plats of potatoes sprayed with Bordeaux mixture and Bug Death, Bordeaux mixture and Paris green, soda Bordeaux and Paris green, and the insecticides used separately.

Five applications were given the vines, beginning July 2 and continuing at intervals of about 10 days. The potatoes were dug October 6 and the yields, increase in crop, and cost of spraying are shown in tabular form. It appears that the Bordeaux-Bug Death mixture gave the greatest increase, the net increase in value amounting to $21.86 per acre. This was followed by ordinary Bordeaux mixture and Paris green, which gave a net increase of $17.68 per acre The exact cost of application is not given, the expense of applying the fungicides to small plats being relatively much greater than had larger tracts been used.

The cost of applying the Bordeaux-Bug Death mixture was greater than where Bordeaux mixture or Paris green was employed, so that the difference in net gain between the two is less than indicated above. The greater efficiency of the Bordeaux-Bug Death mixture is attributed to its more adhesive power.

Downy mildew, or blight, of potatoes, G. P. CLINTON (*Connecticut State Sta. Rpt 1904, pt. 4, pp. 363–384, pls. 6*).—In 1902 the author began a series of spraying experiments with potatoes to determine the amount of injury due to *Phytophthora infestans*, and, secondly, to determine the most effective and practical method of spraying to prevent it. In this report he presents the results and offers suggestions based upon the experiments thus far carried out.

While the blight fungus is one of the most serious pests of the potato in Connecticut, the author states that frequently injuries caused by other organisms are attributed to it. The results obtained in spraying with Bordeaux mixture vary with different seasons, but depend largely on the thoroughness of the treatments and their application at the proper time. Increased yields due to spraying, varying from almost nothing to over 100 per cent, are noted; to be economically profitable the author says that an average gain of 15 to 20 per cent should be obtained.

Where late potatoes are sprayed for the blight the author advocates 3 to 4 thorough applications of Bordeaux mixture, the first to be made between July 5 and 15 and the last about the end of August or first of September.

"Wet rot" of potatoes, C. T. MUSSON and G. MARKS (*Agr. Gaz. N. S. Wales, 16 (1905), No. 2, pp. 186–193, figs. 4*).—A disease of potatoes, to which the name "wet rot" is given, is described.

In the field the disease rapidly destroys plants here and there in the rows, but seldom are contiguous specimens attacked. The isolated plants exhibit characters which are attributed to attacks of bacteria, and it is believed that the organism is present in the seed tuber and develops with the development of the plant. Investigations have been carried on to determine this fact, and the authors believe it to be thoroughly demonstrated that the disease is transmitted through the seed tubers.

There is no external indication of the presence of the disease in the harvested tubers, but if cut in two characteristic brown spots, running in an irregular line throughout the tuber, are to be found. All such tubers should be rigorously excluded in planting, and if the crop shows signs of disease, all plants attacked should be dug up and destroyed at once.

Downy mildew, or blight, of muskmelons and cucumbers, G. P. CLINTON (*Connecticut State Sta. Rpt. 1904, pt. 4, pp. 329–362, pls. 3*).—A description is given of the downy mildew or blight of muskmelons, in which the early record, distribution, host plants, systematic position of the fungus, its life history, etc., are described. The fungus, which has hitherto been referred to the genera Peronospora and Plasmopara, the author shows is entitled to generic rank, and he proposes for it the name *Peronoplasmopara cubensis*.

A review is given of experiments which have been carried on in different places for the control of this disease. The consensus of opinion seems to favor the spraying of cucumbers with Bordeaux mixture for their protection. From the author's experiments, based on 3 years' investigations with muskmelons, it is concluded that when the downy mildew is very severe spraying the muskmelons is useless, but when seasons are cold and damp and the fungi are not unusually destructive, spraying may show some benefit. During warm dry seasons, such as are necessary for the development of muskmelons in Connecticut, the fungus does not occur abundantly enough to warrant spraying; and everything considered, the spraying of muskmelons is not to be recommended in the State.

A bibliography of nearly 70 publications relating to this fungus and the disease it causes is given.

Notes on Pseudomonas campestris, H. A. HARDING and M. J. PRUCHA (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 483, 484*).—An account of experiments carried on at the New York State Station with the black rot organism which attacks cabbage, cauliflower, and allied plants.

Previous investigations regarding this parasite have been reported (E. S. R., 16, pp. 170, 480), and in the present paper an account is given of the resistance of the organism to drying. When exposed on sterile cover slips the bacteria did not survive a 10-day drying, but they were found to retain their vitality on cabbage seed for more than a year. Cabbage plants inoculated with pure cultures obtained from seed 13 months after infection showed a blackening of the veinlets in the leaf, and other evidences of disease after an interval of 16 days.

Peach leaf-curl (*Bd. Agr. and Fisheries [London], Leaflet 120, pp. 3, fig. 1*).—A description is given of the peach leaf-curl, caused by *Exoascus deformans*, together with suggestions for its control. It is stated that the remedies recommended in the United States are inadequate in England, repeated experiments having shown that spraying with Bordeaux mixture will not wholly control the disease. In addition to spraying, the removal of the diseased shoots which bear the characteristic tufted leaves is recommended.

Bacterial infection by way of the stomata in black spot of the plum, E. F. SMITH (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 502*).—In continuation of previous investigations (E. S. R., 14, p. 531) the author has studied the bacterial infection of the black spot of the plum.

Numerous infections were obtained through the stomata by spraying dissolved cultures of the *Pseudomonas pruni* over leaves and green fruits. When this was done during damp weather the spots became visible in 7 days. Microscopic investigations showed the characteristic appearance of the disease and the organism was readily recovered by means of agar plates. A neighboring tree inoculated at the same time and in the same way, but with a different organism, never showed any results. No spots were obtained on full-grown plums, although numerous attempts were made under what appeared to be favorable conditions. The disease appears to be one limited strictly to meristomatic tissues.

The cedar and pear rust, P. PASSY (*Rev. Hort. [Paris], 77 (1905), No. 5, pp. 114–118, figs. 8*).—The author describes the relation between the Gymnosporangium occurring on cedars, or species of Juniperus, and the Rœstelia stage occurring on pears, etc.

Diseases of the grape in Ontario in 1904, W. T. MACOUN (*Canada Expt. Farms Rpts. 1904, pp. 123–125*).—The author briefly describes the anthracnose, black rot, brown rot or downy mildew, powdery mildew, ripe rot, and leaf blight of grapes.

A fungicide for use in combating grape gummosis, DE SOKOLNICKI (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 12, p. 355*).—A formula is given of a fungicide which is recommended as a wash for grapevines to protect them against gummosis. The fungicide consists of water 100 liters, mercuric nitrate 300 gm., and sulphuric acid sufficient to make the solution clear.

A coffee leaf fungus, H. N. RIDLEY (*Agr. Bul. Straits and Fed. Malay States, 3 (1904), No. 12, pp. 492, 493*).—A disease is described which attacks the leaves and berries of coffee, forming over the leaves a dense white mycelium and causing the unripe berries to become depressed over the surface and more or less blotched with brown.

The author suspects the fungus to be a species of Corticium, but so far has not been able to positively identify it. The disease is most troublesome during wet weather or in thickly shaded portions of the plantation, and it largely disappears with the advent of dry weather. As a precautionary measure it is recommended that where the fungus occurs steps should be taken to secure a better circulation of air and a freedom from too much moisture.

Pecan scab, W. A. ORTON (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 503*).—A description is given of a disease of considerable economic importance caused by attacks of *Fusicladium effusum* on the leaves, twigs, and nuts of cultivated pecans in the Southern States.

The fungus occurs on either side of the leaves and on the petioles, producing dead spots or distortions and defoliation. Sometimes the new growth of the twigs is killed, but the greatest injury is to the nuts. The microscopic and cultural characters of the fungus are described, showing it to be identical with *F. carygenum*. Favorable results from spraying experiments are reported.

Pests of ornamental shrubbery, M. C. COOKE (*Jour. Roy. Hort. Soc.* [*London*], *29 (1904), No. 1–3, pp. 1–25, pls. 3*).—Annotated notes are given on the occurrence of parasitic fungi on a number of ornamental shrubs. The fungi and tneir effect on the hosts are briefly described, and notes given on their distribution, habits, etc.

The bud rot of the cocoanut palm in the West Indies, E. F. SMITH (*Abs. in Science, n. ser., 21 (1905), No. 535, pp. 500–502*).—Attention is called to a serious disease of cocoanut palms, previous notes of which have been given (E. S. R., 14, pp. 671, 882).

The disease is said to have made decided advances since reported in 1901, and in many regions the planters are becoming discouraged, since trees of all ages and on all sorts of soils are being destroyed. In all the cases examined the roots and stem seemed to be sound. The general symptoms of the disease are the yellowing and falling of the outer leaves, the shedding of the nuts, followed in several months by the death of the whole crown.

An examination showed that the disease was located in the crown, where the organism produces an ill-smelling soft rot. The rot is invisible until the outer leaf sheaths are removed, when the entire bud will be found affected. The disease stops very promptly after having destroyed the undeveloped tissues of the bud, and does not seem to be able to attack the harder tissues of the palm stem.

The bacteria are believed to have found entrance through wounds of some kind, and their distribution is undoubtedly favored by flies and other insects. All diseased trees, it is said, should be cut down, and the terminal buds destroyed or treated with some strong fungicide.

Some diseases of loblolly pine timber, H. VON SCHRENK (*Abs. in Science, n. ser., 21 (1905), No. 535, p. 502*).—The author states that the living tree of the loblolly pine is subject to the attacks of several fungi, notably *Trametes pini* and *Polyporus schweinitzii*. After the timber is cut it is said to be very susceptible to fungus attacks, and it is probably the least resistant of all American woods.

A number of fungi are known to grow on the timber, living on the starch or exuding resins, but the most destructive enemy of the loblolly pine is *Lenzites sepiaria*, which causes a brown rot. The various forms of the fruiting body of the fungus are described, and accounts given of experiments to test the susceptibility of timber to this fungus. It was found that proper piling would to a considerable extent protect the timber for some time.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Ground squirrels and other rodent pests in Nevada, P. FRANDSEN (*Nevada Sta. Bul. 58, pp. 34, pls. 5, figs. 7*).—In Nevada there are 3 species of ground squirrels, *Citellus beecheyi*, *C. oregonus*, and *C. beldingi*. *C. oregonus* is the only one of economic importance. The author discusses in detail the habits and food of ground squirrels. The badger, coyote, hawks, and owls are their chief enemies. Ground squirrels cause great damage by destruction of grain, alfalfa, and garden crops, by eating range grasses, and by interfering with irrigation as a result of their burrowing.

Experiments were made in poisoning ground squirrels with strychnin, corrosive sublimate, red and yellow phosphorus, potassium cyanid, arsenic, etc. Of these strychnin was most satisfactory. It was used on bacon, corn meal, raisins, dutch cheese, wheat, etc. In fumigating carbon bisulphid alone or mixed with gasoline gave excellent results. The use of cultures of disease germ from the Pasteur Institute was without effect. Ground squirrels may also be trapped or destroyed by irrigation and dogs. The author favors poisoning in early spring as the best method of exterminating the pests.

The habits of the pocket gopher are also described. This pest is very injurious to alfalfa and garden crops. They may be drowned out and caught with dogs or poisoned. Good results were had in the use of poisoned baits for destroying jack rabbits and other harmful rodents.

Prairie dogs, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 128, p. 262*).—Prairie dogs were exterminated on 400 badly infested acres for $33.50, or about 8 cts. per acre. At first poison was distributed, after which the inhabited holes were treated with carbon bisulphid and gasoline.

The relation of coyotes to stock raising in the West, D. E. LANTZ (*U. S. Dept. Agr., Farmers' Bul. 226, pp. 24, fig. 1*).—This is essentially a popular edition of Bulletin 20 of the Division of Biological Survey (E. S. R., 16, p. 1055).

The relation of birds to fruit growing in California, F. E. L. BEAL (*U. S. Dept. Agr. Yearbook 1904, pp. 241–254*).—In California birds injure fruit more than in the Eastern States for the reason that wild fruits are comparatively rare in the fruit regions of California and water is scarce. Among the birds which injure fruit in California special mention is made of linnet, Brewer blackbird, black-headed grosbeak, California jay, California Valley quail, Bullock oriole, russet-back thrush, robin, etc. Detailed notes are given on the feeding habits and economic relations of each of these species.

Some benefits the farmer may derive from game protection, T. S. PALMER (*U. S. Dept. Agr. Yearbook 1904, pp. 509–520*).—This subject is discussed with special reference to the following topics: Relation of the farmer to game laws, game protection as a check on hunting, protection of property and useful birds, exclusion of harmful species, and financial and indirect benefits. Practical illustrations are drawn from the working of game laws in various States.

Monthly bulletin of the division of zoology, H. A. SURFACE (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 2 (1905), Nos. 10, pp. 291–320, pls. 2, figs. 7; 11–12, pp. 323–378, fig. 1; 3 (1905), No. 1, pp. 32*).—No. 10 contains brief notes on the feeding habits of birds, the distribution of San José scale in Pennsylvania and methods of combating it, the use of insecticides, the collection of insects, beekeeping, State natural history museum, etc.; No. 11–12 gives general suggestions for spring spraying, together with notes on collecting insects, San José scale, fumigation, "cabbage snake," potato scab, mosquitoes, diseases of bees, cankerworm, etc.; and No. 1, a spray calendar, containing directions for preparing remedies and times of application in the control of insect pests and plant diseases on common cultivated plants. Brief notes are also presented on cankerworm, tent caterpillar, and codling moth.

The annual loss occasioned by destructive insects in the United States, C. L. MARLATT (*U. S. Dept. Agr. Yearbook 1904, pp. 461–474*).—The basis of estimating losses from insects is explained, together with notes on the control of insects. Estimates are made of the insect damage to corn, wheat, hay, cotton, fruits, forests, cattle, stored products, etc. According to these estimates the total loss from insects in the United States is $700,000,000 per year.

Insect pests of house and garden, M. V. SLINGERLAND (*Cornell Reading Course for Farmers' Wives, 2. ser., 1905, No. 10, pp. 185–200h, figs. 11*).—Brief descriptions are presented of clothes moth, carpet beetle, cockroaches, bedbugs, fleas, mosquitoes,

flies, ants, and other insects which are injurious to clothing, furniture, or food, or which annoy man otherwise. Proper remedies are suggested for the control of these pests.

Collecting and preserving insects, F. SHERMAN, Jr. (*N. C. Dept. Agr. Ent. Circ. 15, pp. 14, figs. 9*).—Brief directions are given regarding the necessary apparatus and methods to be adopted in collecting and preserving various kinds of insects.

Entomology in schools, H. S. SAUNDERS (*Canad. Ent., 37 (1905), No. 2, pp. 33, 34, pl. 1*).—A brief account is presented of the classification of the insects with suggestions as to how collections of insects may be made for use in teaching entomology in schools.

The colors of insects, A. U. BATTLEY (*East Kent Sci. and Nat. Hist. Soc. Rpt. and Trans., 2. ser., 4 (1904), pp. 4–6*).—Colors in insects are largely due to the unequal refraction of the light or to actual pigments deposited in definite particles in the integument. The significance of color in insects is briefly discussed.

How do insects pass the winter? J. FLETCHER (*Canad. Ent., 37 (1905), No. 3, pp. 79–84*).—Brief notes were given on the methods of hibernation observed in various species of insects.

Report of the entomologist, J. FLETCHER (*Canada Expt. Farms Rpts. 1904, pp. 210–251, pls. 2*).—During the season under report cereals were attacked by wireworms, cutworms, grasshoppers, Hessian fly, wheat-stem sawfly, grain aphis, and wheat midge.

Wireworms may be partly controlled by 2 plowings in autumn. The Criddle mixture continues to give good results in combating grasshoppers. Locust fungus was effective in a few instances only. There is apparently but one brood of Hessian fly in western Canada. The pea weevil has appeared only in very small numbers for the past 2 years. The cause of its disappearance is not known. It is recommended that all seed peas be treated before sowing and that the crop be harvested as early as possible.

Notes are given on bollworm, *Eriopeltis festucæ*, various cutworms, root maggots on onions, cabbage, and radish, *Nectarophora solanifolii* on potatoes, *Entomoscelis adonidis* on turnips, *Pionea straminalis* on cabbage, San José scale, plum aphis, plum curculio, apple maggot, codling moth, and various pests of forest and shade trees.

J. Fixter reports on the apiary. The best cellar temperature for the winter is 42 to 48° F. Colonies passed the winter well when the tops of the hives were replaced with chaff cushions or propolis quilts. Successful wintering appears to depend on uniformity of temperature and good ventilation. In a comparison of sugar sirup and extracted honey colonies consumed during the winter on an average 62 lbs. 1 oz. of the former and 62 lbs. 8 oz. of the latter. Notes are also given on methods of introducing queens.

Common injurious and beneficial insects of Maryland, T. B. SYMONS (*Maryland Sta. Bul. 101, pp. 125–204, figs. 52*).—The author presents a list of insects contained in the entomological exhibit of the station and used at county fairs and farmers' meetings throughout the State. The insects in the collection are classified in general according as they affect orchards, grains, vegetables, household goods, etc. Beneficial insects are also mentioned and brief directions given for the preparation of insecticides.

Miscellaneous cotton insects in Texas, E. D. SANDERSON (*U. S. Dept. Agr., Farmers' Bul. 223, pp. 24, figs. 29*).—Biological, descriptive, and economic notes are presented on a large number of cotton insects, including cutworms, plant lice, webworms, white-lined sphinx, grasshoppers, May beetles, *Œcodoma fervens, Uranotes melinus*, leaf hoppers, plant bugs, etc. In controlling these cotton pests it is recommended that weeds near cotton fields be destroyed and clean cultivation be adopted.

The cotton bollworm, A. L. QUAINTANCE and C. T. BRUES (*U. S. Dept. Agr., Bur. Ent. Bul. 50, pp. 155, pls. 25, figs. 27*).—This constitutes an elaborate monograph of

the bollworm, including an account of its systematic position, distribution, economic status, appearance in different stages, life history, natural enemies, and methods of control. The literature relating to the pest is reviewed in connection with an extensive bibliography.

The injury of the insect to corn, cotton, and tomatoes is described. The predaceous and parasitic enemies of the pest are discussed, together with a bacterial disease which seems to be contagious but not adapted to practical use in destroying bollworms. The cultural methods of controlling the insect consist in thorough plowing, use of seed of early varieties, use of fertilizers, early planting, thorough cultivation.

Corn may be used as a trap crop. The young larvæ may be killed by application of arsenicals during the last week in July and the first two weeks of August. Dusting seems better than spraying. In dusting, Paris green may be used at the rate of 2 or 3 lbs. per acre for each application. The work should be done at night or when the leaves are moistened with dew. Paris green may be applied in cheap flour or dry slaked lime at intervals of 7 to 10 days as long as the larvæ are found in exposed positions.

The Mexican cotton boll weevil, W. D. HUNTER and W. E. HINDS (*U. S. Dept. Agr., Bur. Ent. Bul. 51, pp. 181, pls. 23, figs. 8*).—This is essentially a revised and enlarged edition of Bulletin 45 of the Bureau previously noted (E. S. R., 16, pp. 73, 74). Part of the information contained in the bulletin is also contained in Farmers' Bulletin 216 (E. S. R., 16, p. 991) and Bureau of Entomology Circular 56 (E. S. R., 16, p. 576).

The present account is a monograph of the boll weevil and contains a discussion of the insect from every standpoint. The investigations of 1904 served to confirm previous studies. The recommendations regarding cultural methods are repeated. A bibliography of the subject is appended to the bulletin.

Present status of the cotton boll weevil in the United States, W. D. HUNTER (*U. S. Dept. Agr. Yearbook 1904, pp. 191–204, pls. 2, fig. 1*).—An account is given of the territory affected by this pest, the amount of damage done, and the investigations of this Department concerning the boll weevil, together with notes on problems still to be solved.

Work of the Bureau of Plant Industry in meeting the ravages of the boll weevil and some diseases of cotton, B. T. GALLOWAY (*U. S. Dept. Agr. Yearbook 1904, pp. 497–508*).—The work of the Bureau in this field is briefly outlined under the heads of plant breeding, tropical cottons, diseases of cotton, diversification farms, cooperative demonstration farms, early maturing varieties of cotton, and farmers' institute work. Considerable improvement in farm economy has been noted as a result of these investigations.

Effect of certain arsenites on potato foliage, W. H. JORDAN, F. C. STEWART, and H. J. EUSTACE (*New York State Sta. Bul. 267, pp. 263–284, pls. 2, fig. 1*).—Paris green and arsenite of lime were tested to determine to what extent they are injurious to potato leaves.

Paris green was applied 4 times either with water, lime water, or Bordeaux mixture. Arsenite of lime was prepared by the Kedzie formula, with lime water and with Bordeaux mixture. In testing Paris green potatoes were sprayed July 7, 22, 29, August 12 and 25. No evidence of injury to the leaves from Paris green was noted, even when used at the rate of 4½ lbs. per acre. Paris green proved to have considerable fungicidal power (one-third as much as Bordeaux mixture) in preventing late blight. The yield in treated rows was much greater than in check rows.

Potatoes were sprayed 4 or 5 times with arsenite of lime. The results obtained indicate that this remedy can not safely be used except with Bordeaux mixture. When applied otherwise, the foliage was badly burned and the yield of potatoes reduced.

Poisoning the potato beetle, F. H. HALL, W. H. JORDAN, ET AL. (*New York State Sta. Bul. 267, popular ed., pp. 11, figs. 2*).—A popular summary of Bulletin 267 of the station noted above.

The bulb mite, R. S. MACDOUGALL (*Jour. Bd. Agr.* [*London*], *11* (*1905*), *No. 12, pp. 748–751, figs. 2*).—*Rhizoglyphus echinopus* feeds on the underground stems and roots of tulips, hyacinths, onions, and on potatoes and other plants. The insect is described in its different stages and notes are given on means of combating it.

In cases of bad infestation it is stated that the best way of controlling the mite is to burn infested bulbs and thoroughly sterilize infested soil. The mite may also be destroyed by spraying bulbs with kerosene, washing them in a solution of sulphid of potassium at the rate of 1 oz. to 3 gal. of water, or fumigating with bisulphid of carbon.

Cabbage root maggot. Poisoned bran for cutworm, W. S. BLAIR (*Canada Expt. Farms Rpts. 1904, pp. 362–364*).—Cabbage was treated for root maggot with hellebore, kerosene emulsion, Paris green, and tar paper disks. Hellebore gave the best results (2 to 4 oz. to the gallon of water).

Paragrotis ochrogaster in gardens was easily controlled by the use of a poisoned bait containing 3 oz. Paris green per 10 lbs. bran.

The imported cabbage worm, F. H. CHITTENDEN (*U. S. Dept. Agr., Bur. Ent. Circ. 60, pp. 8, figs. 6*).—*Pontia rapæ* is described in its various stages and notes are given on its life history. The species was introduced about 50 years ago, and is far more injurious than the native species. It is a serious pest from Canada to the Gulf region.

The imported cabbage butterfly feeds on all crucifers and various ornamental plants such as mignonette, Cleome, etc. Numerous parasites and predaceous insects help to keep the pest in check. The best remedy is spraying with arsenicals. Poisoned bran mash, hot water, kerosene emulsion, pyrethrum, clean cultivation, hellebore, and other remedies have been tried with more or less benefit.

The cabbage hair-worm, F. H. CHITTENDEN (*U. S. Dept. Agr., Bur. Ent. Circ. 62, pp. 6, fig. 1*).—*Mermis albicans*, a species of hair-worm, was found in heads of cabbage in certain Southern States in 1903. Exaggerated stories were circulated regarding its poisonous properties. These were shown to be without foundation. Repeated experiments showed that the worm is not poisonous. It lives as a parasite in the body of grasshoppers, codling moth, and other insects. The life history of the worm is discussed, and miscellaneous information presented concerning it.

The biology and systematic position of Otiorhynchus turca, A. A. SSILANTJEW (*Zool. Jahrb., Abt. System. Geogr. u. Biol. Thiere, 21* (*1905*), *No. 4, pp. 491–502, figs. 8*).—This pest of the grape vine has been known since 1843. The insect is carefully described with particular reference to anatomical details and to its life history. The hibernating beetles attack the buds and young leaves in early spring. The eggs are laid about the middle of June. The author reports that all the beetles which he collected from June to September were females and he was unable to explain this fact.

Insect injuries to forest products, A. D. HOPKINS (*U. S. Dept. Agr. Yearbook 1904, pp. 381–398, figs. 14*).—An account is presented of the injuries caused by ambrosia beetles, round-headed borers, flat-headed borers, timber worms, powder post borers, white ants, carpenter bees, etc. The conditions which are favorable to insect injury of this sort are also outlined.

The nut weevils, F. H. CHITTENDEN (*U. S. Dept. Agr. Yearbook 1904, pp. 299–310, pls. 3, figs. 10*).—A detailed discussion is presented on *Balaninus proboscideus, B. rectus, B. caryæ*, and *B. obtusus*. The first two species affect chestnuts, the third pecans, and the last hazelnuts. Successful remedies against chestnut weevils are bisulphid of carbon, scalding and drying, dry heat or cold storage. Hogs may be allowed in pecan orchards to destroy infested nuts.

Black check in western hemlock, H. E. BURKE (*U. S. Dept. Agr., Bur. Ent. Circ. 61, pp. 10, figs. 5*).—Black check is a defect of western hemlock due to the attack of a bark beetle (*Hylesinus* n. sp.), in the burrows of which a bark maggot (*Cheilosia alaskensis*) penetrates and increases the injury. On low land a large percentage of the wood is thus rendered worthless for finishing, staves, or woodenware. *C. hoodianus* causes a similar injury to *Abies grandis*. In order to avoid getting lumber with this defect, it is suggested that trees be selected from altitudes of 1,800 ft. or more.

The felted beech coccus, R. NEWSTEAD (*Jour. Bd. Agr.* [*London*], *11* (*1905*), *No. 12, pp. 755–760, figs. 7*).—*Cryptococcus fagi* confines its attacks to the beech and is considered one of the most destructive pests which attacks this tree. It occurs generally in England and in some parts of Scotland. The insect is described and notes are given on its life history. It may usually be controlled by spraying with kerosene emulsion with or without the addition of sulphur and turpentine or by treatment with caustic-alkali wash.

The chief injurious scale insects of Connecticut, W. E. BRITTON (*Connecticut State Sta. Bul. 151, pp. 16, figs. 17*).—The more important scale insects of Connecticut are described and arranged in a convenient manner for identification. In this manner the author discusses 29 species including elm scale, cottony maple scale, tulip scale, oleander scale, San José scale, oyster-shell scale, etc.

Spraying for scale insects, H. J. QUAYLE (*California Sta. Bul. 166, pp. 24, figs. 2*).—Spraying experiments were conducted against the brown apricot scale and San José scale.

Lime-sulphur-salt wash was tested in various formulas. Lime, sulphur, and salt were used at the rate of 40, 20, and 15 lbs., respectively, for each 60 to 120 gals. of water. All dilutions up to 90 gals. of water were effective. In another set of tests the amount of lime for each 60 gals. of water varied from 20 to 50 lbs. All combinations were effective, but a slight excess of lime seemed to be beneficial. In other experiments the amount of sulphur ranged from 5 to 40 lbs. Solutions containing small amounts of sulphur were less efficient. The author is not prepared to recommend the disuse of salt. Copper sulphate used to replace salt removed the moss from trees but otherwise had no advantage.

In general the lime-sulphur-salt wash proved effective against San José scale, but not against the brown apricot scale. It should be used chiefly on dormant trees. Preparation of the wash without boiling does not reduce the cost. Resin wash was satisfactory for brown apricot scale but not for San José scale. It should be applied in January and February. Patent compounds have no advantages over standard remedies. The standard 3 per cent distillate insecticide was not very effective against the brown apricot scale.

Insects injurious to roses, P. LESNE (*Rev. Hort.* [*Paris*], *77* (*1905*), *No. 7, pp. 167–170, pl. 1*).—Descriptive, economic, and biological notes are given on a number of rose pests, including gypsy moth, brown-tailed moth, rose scale, *Cladius pectinicornis*, etc.

Insecticides and fungicides, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30* (*1904*), *pp. 63, 64*).—Brief notes are given on the preparation of lime-sulphur washes and an analysis of fungeroid is reported.

Bees, S. A. BEDFORD (*Canada Expt. Farms Rpts. 1904, pp. 394, 395*).—Brief notes on apiculture in Manitoba.

FOODS—HUMAN NUTRITION.

Wheat and flour, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30* (*1904*), *pp. 54–60*).—Milling tests were made with ten samples of different grades of wheat grown near Winnipeg, as well as studies of the moisture and proteids and

acidity of the flours, and baking tests made immediately after grinding and after storing the flour for ten weeks. Data regarding tests of the baking quality and grade of some of the samples which were sent to the Columbus Laboratories of Chicago for examination are also reported.

In the author's opinion it is evident that there is not much difference in the real value of the different grades of wheat tested. No regular variation was noted in the quantity of total proteids and gluten or in the quality of the gluten of the highest and lowest grades. All the samples gave fairly satisfactory bread as judged by quality and yield. In the majority of cases the yield of bread was practically the same. As regards the amount of bread obtained from new and stored flour, the agreement was fairly close except with two samples. The flours were all straight grade and the gluten content and consequently the loaf volume was small.

"It must be remembered that . . . [the results were] obtained from a very few samples of wheat. The nature of the soil, the number of crops grown in it since 'breaking,' the weather at the time of ripening, etc., all have an influence on the quality of the wheat. Therefore, these results, while accurate for the samples submitted, should not be given too much importance until they are confirmed by further work."

Three varieties of wheats received from the Northwest Territory government were also examined. They were found to contain "a fairly high percentage of proteids, fully as high as the samples of the various grades previously mentioned. They also contain as much alcohol soluble proteids, or gliadin, as the wheats referred to, and, so far as can be judged from these results, ought to be equal to them for flour purposes."

In a study of the quality of flour from wheats grown in Manitoba in the Northwest Territories in 1904, it was found that the gliadin content was uniformly low.

"The effect of low gliadin content would be that the gluten would be weak, the acids developed during fermentation would more quickly dissolve or 'rot' the tenacious part of the gluten and allow the gases to escape. As a result the bread would be heavy. Just what causes this low gliadin content in the wheat is not known. It apparently is not caused by the soil, for these variations in strength come from year to year in wheat grown on the same soils. It is more likely due to weather conditions at the time the nitrogenous substances are being transferred from stem to seed, or during the ripening process."

In connection with the studies of flour, determinations have been made of the acidity of a large number of samples, with a view to learning the limits of acidity and devising a method for judging of the soundness of flour by the amount of acid present. Definite conclusions were not drawn. According to the author, "The better grades of flour show a very small acid content, but the amount increases with the lower grades. Flours which have taken up an undue amount of moisture, or which have been made from damp wheat, also show high acid content."

Inspection of foreign food products, H. W. WILEY (*U. S. Dept. Agr. Yearbook, 1904, pp. 151-160*).—The scope of the law regarding the inspection of imported food products, the extent of the work, and some of the results obtained and related topics are spoken of. It is pointed out that under the law the inspection work includes foods, drugs, beverages, condiments, and the ingredients of such articles.

An idea of the extent of the work and the character of the goods imported may be gathered from the fact that of 1,880 samples of wine, meat, olive oil, and miscellaneous products, 223 were found to be contrary to the law, while the remaining 1,657 were found to comply with the law. In the author's opinion the inspection of imported food products, although it has been in force less than two years, has already given beneficial results.

"It is gratifying also to know that the exporters in foreign countries, as a rule, have been eager to learn of the exact character of the requirements of the law, and in many

cases have made an earnest effort to comply with them. Nevertheless, as in all cases, there are some instances where it is evident that compliance with the law will only be secured by its rigid execution, and not by voluntary action."

Food consumption in Southern Italy, H. LICHTENFELT (*Arch. Physiol. [Pflüger], 107 (1905), No. 1-2, pp. 57-80*).—The author has summarized a large amount of data regarding the food consumption in different regions of Southern Italy, which is discussed with reference to the productive power of the people.

In his opinion the inhabitants of Southern Italy are smaller in size and do not work as effectively as inhabitants of other parts of Italy. This is attributed to the low energy value of the diet, the excess of carbohydrates, and the insufficiency of animal food. The author believes that, in general, growth is hindered and physical condition lowered if the supply of animal food is insufficient.

Analyses of fresh chestnuts, B. TOMEI (*Staz. Sper. Agr. Ital., 37 (1904), No. 2-3, pp. 185-199*).—The proximate and ash analyses reported are discussed with reference to the food value of chestnuts and the fertilizers which the tree requires.

Prussic acid in cassava roots (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1904, No. 41, pp. 26, 27*).—Attention is called to the fact that sliced or grated cassava when allowed to stand sometimes becomes poisonous. The whole question of cassava poison is briefly discussed from the standpoint of the possibility of the formation of hydrocyanic acid from a glucoside by the aid of a ferment. The need of investigating this question is spoken of.

The preservation of fruits and vegetables, V. VALVASSORI (*Bul. Off. Gouvt. Gén. Algérie, 1904; abs. in Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 5, p. 592*).—A summary of data regarding the length of time fruit and vegetables may be kept in cold storage.

The use of food preservatives, V. C. VAUGHAN (*Jour. Amer. Med. Assoc., 44 (1905), No. 10, pp. 753-756*).—A summary of data on legal enactments, the effects of preservatives on digestion, and related questions.

The importance of studying food in connection with nutrition as a part of a course in domestic economy, C. NOURRY (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 3, pp. 216-218*).—A number of suggestions regarding the teaching of nutrition are made.

Handbook of sanitation, G. M. PRICE (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1905, pp. XV+301, figs. 29*).—In this, the second edition, the author states that many changes have been made and that the subject matter of the section dealing with foods and some other sections have been very largely rewritten. The volume is designed as a manual of theoretical and practical sanitation for students, physicians, building inspectors, and others interested in sanitary problems.

The respiration calorimeter, W. O. ATWATER and F. G. BENEDICT (*U. S. Dept. Agr. Yearbook, 1904, pp. 205-220, pl. 1, figs. 2*).—The respiration calorimeter used in the Department nutrition investigations for studying the total income and outgo of matter and energy is described, and some of the more important results of experiments are summarized.

It was found that the output of carbon dioxid and heat is very nearly proportional to the amount of muscular work performed, the figures given ranging from 25 gm. of carbon dioxid and 65 calories of heat per hour with a man at rest and sleeping, to 210 gm. and 600 calories with a man at very severe muscular work. Other topics discussed have to do with problems of ventilation, the normal variations in body temperature, etc.

Approximately complete analyses of thirty normal urines, O. FOLIN (*Amer. Jour. Physiol., 13 (1905), No. 1, pp. 45-65*).—Detailed analyses of the urine samples were made, the methods followed being described. The subjects were healthy men. The diet which the urines represent was made up of whole milk, cream, eggs, malted milk, sugar, and salt, mixed with water and taken in liquid form.

Water was also used as a beverage. The chlorin, sulphur, phosphoric acid, and nitrogen in the diet was determined, the amount of nitrogen furnished per day ranging from 18.80 to 19.05 gm.

Laws governing the chemical composition of urine, O. FOLIN (*Amer. Jour. Physiol., 13 (1905), No. 1, pp. 66–115*).—A study of the urine of a subject who was accustomed to live on a diet containing small amounts of protein showed that the constituents were not present in the same proportions as in so-called normal urine, the urea nitrogen constituting a much smaller percentage of the total than is generally the case. Differences in the proportions of other constituents were also found.

A number of studies were, therefore, undertaken with healthy subjects in which a period of 3 or 4 days on a diet furnishing about 19 gm. of nitrogen was followed by a period of 7 or 10 days' duration with a diet made up of 300 cc. of cream and 400 gm. of pure arrowroot starch, the total nitrogen supplied being only about 1 gm. per day. The experiments closed with a period of 1 or 2 days' duration on a diet like that in the first period.

The results obtained with the different subjects were uniform, quantitative changes in the daily proteid metabolism on the different diets being accompanied, according to the author, by pronounced changes in the distribution of the urinary nitrogen and sulphur, and the author believes that "the distribution of the nitrogen in urine among urea and the other nitrogenous constituents depends on the absolute amount of total nitrogen present. . . . The distribution of the sulphur in urine among the 3 chief normal representatives—inorganic sulphates, ethereal sulphates, and 'neutral sulphur'—depends on the absolute amount of total sulphur present."

As regards the different urine constituents "the absolute quantity of creatinin eliminated in the urine on a meat-free diet is a constant quantity, different for different individuals, but wholly independent of quantitative changes in the total amount of nitrogen eliminated. . . . When the total amount of protein-metabolism is greatly reduced, the absolute quantity of uric acid is diminished, but not nearly in proportion to the diminution in the total nitrogen, and the per cent of the uric acid nitrogen in terms of the total nitrogen is therefore much increased. . . . With pronounced diminution in the protein metabolism (as shown by the total nitrogen in the urine), there is usually, but not always, and therefore not necessarily, a decrease in the absolute quantity of ammonia eliminated. A pronounced reduction of the total nitrogen is, however, always accompanied by a relative increase in the ammonia nitrogen, provided that the food is not such as to yield an alkaline ash."

As regards the urea, this suffers a relative as well as an absolute diminution with a diminution in the total proteid metabolism, 60 per cent being recovered in the urine, when the total nitrogen elimination is reduced to 3 or 4 gm. as compared with about 90 per cent of the total nitrogen in normal urine.

Decided diminutions in the daily elimination of total sulphur were accompanied by reductions in the percentage of sulphur present as inorganic sulphates, the reduction being as great as in the case of urea. The neutral sulphur elimination was analogous to that of creatinin and, according to the author, it represents products which in the main are independent of the total amount of sulphur eliminated by protein catabolism. The percentage of total sulphur excreted as ethereal sulphates increased and, according to the author, these ethereal sulphates represent a form of sulphur metabolism which becomes more prominent when the food contains little or no protein.

The volume of urine it was found depended entirely upon the amount of water consumed. The chlorin elimination, as is generally conceded, was found to vary chiefly with the volume of urine provided the amount consumed was constant.

Studies of the acidity of urine and methods of estimating acid led to the conclusion that "the phosphates in clear acid urine are all of the monobasic kind, and the acidity of such urines is ordinarily greater than the acidity of all the phosphates,

the excess being due to free organic acids." The excess of inorganic acids observed in urine diminished under the influence of the starch and cream diet until it frequently became a minus quantity.

When potatoes replaced pure starch in the diet, "the total acidity of the urine is but slightly reduced, and the total amount of organic acids eliminated is greatly increased, yet the ammonia is still considerable. This would seem to indicate that a part of the acid and ammonia formation within the organism is not affected by the alkalies of the food."

A theory of protein metabolism, O. Folin (*Amer. Jour. Physiol., 13 (1905), No. 2, pp. 117–138*).—On the basis of investigations noted above, various questions connected with the metabolism of protein in the animal body are discussed.

The fact that, generally speaking, the proportion of urea to total nitrogen in the urine diminished with a decrease in the amount of nitrogen consumed, while the other nitrogenous constituents in the urine remained practically constant, led the author to conclude that there are 2 distinct processes of proteid metabolism in the body. In his opinion the metabolic processes resulting in the end products which tend to remain constant (creatinin, neutral sulphur, and to a less extent uric acid and ethereal sulphates) are needed for the continuation of life; or, in other words, the metabolic processes which they represent constitute an essential part of the activity which distinguishes living from dead cells.

He, therefore, proposes the term "tissue" metabolism or "endogenous" metabolism for this form of proteid cleavage, and "exogenous" or intermediate metabolism for the proteid cleavage which is variable and yields chiefly urea and inorganic sulphates, this form of metabolism being looked upon as an attempt on the part of the body to remove rapidly the surplus nitrogen supplied which is not required for vital processes.

Attention is called to the fact that the nitrogen of protein is linked to carbon on the one hand and to hydrogen on the other—i. e., exists as amido or imido groups—and that from a chemical standpoint the cleavage of such groups is more readily accomplished by hydrolysis than by oxidation.

In the author's opinion exogenous proteid catabolism consists of a series of hydrolytic cleavage processes resulting in a rapid elimination of proteid nitrogen as urea. "According to the views here presented . . . only a small amount of protein, namely, that necessary for the endogenous metabolism, is needed. The greater part of the protein furnished with standard diets like Voit's—i. e., that part representing the exogenous metabolism—is not needed, or, to be more specific, its nitrogen is not needed.

"The organism has developed special facilities for getting rid of such excess of nitrogen so as to get the use of the carbonaceous part of the protein containing it. The first step in this process is the decomposition of protein in the digestive tract into proteoses, amido acids, ammonia, and possibly urea. The hydrolytic decompositions are carried further in the mucous membrane of the intestines, and are completed in the liver, each splitting being such as to further the formation of urea.

"In these special hydrolytic decompositions, the result of which is to remove the unnecessary nitrogen, we have an explanation of why and how the animal organism tends to maintain nitrogen equilibrium, even when excessive amounts of protein are furnished with the food. This excess of protein is not stored up in the organism, as such, because the actual need of nitrogen is so small that an excess is always furnished with the food, except, of course, in carefully planned experiments. The ordinary food of the average man contains more nitrogen than the organism can use, and increasing the nitrogen still further will therefore necessarily only lead to an immediate increase in the elimination of urea, and does not increase the protein catabolism involved in the creatinin formation any more than does an increased supply of fats and carbohydrates.

"All the living protoplasm in the animal organism is suspended in a fluid very rich in protein [which is the protein reserve material of the body], and on account of the habitual use of more nitrogenous food than the tissues can use as protein the organism is ordinarily in possession of approximately the maximum amount of reserved protein in solution that it can advantageously retain."

The view that exogenous metabolism is in the main dependent upon hydrolytic cleavage does not preclude the possibility that a certain amount of oxidation is associated with this form of catabolism and, indeed, the author considers that some oxidation is necessary and discusses its character.

The endogenous proteid metabolism, in the author's opinion, has to do with those forms of proteid cleavage which are actually concerned with the vital processes. The theories advanced by the author are discussed in relation to nitrogen equilibrium, standard diets, diets and diseases, and the effect of work on protein metabolism.

The course of the renal excretion of nitrogen when different sorts of food are taken, N. W. SCHEPSKY (*Inaug. Diss., St. Petersburg, 1900, pp. 38; abs. in Physiol. Russe, 3 (1904), Nos. 48-60, p. 177*).—The conclusion was reached that the increased excretion of nitrogen after food is taken varies with different foods and is parallel to the curve showing the power of each food to induce secretion of digestive juices. In other words, the increased nitrogen excretion shortly after taking food is an expression of the activity of the digestive glands.

The work of the digestive glands when different sorts of food containing fat are eaten, A. M. WIRSCHUBSKIJ (*Inaug. Diss., St. Petersburg, 1900, pp. 55; abs. in Physiol Russe, 3 (1904), Nos. 48-60, p. 177*).—Experiments with dogs with fistulæ showed that fat added to any sort of food had a retarding influence on stomach digestion. The quantity of gastric juice secreted depended upon the character of the food with which the fat was mixed.

The production of fat from proteid by the Bacillus pyocyaneus, S. P. BEEBE and B. H. BUXTON (*Amer. Jour. Physiol., 12 (1905), No. 5, pp. 466-470, fig. 1*).—The authors found that when *Bacillus pyocyaneus* grew in fat-free meat extract broth, a thick pellicle was produced on the surface, which yielded fat on extraction with chloroform, the amount obtained being about 0.3 to 0.4 gm. per liter. Some 10 gm. of the fatty material was collected and its characteristics studied.

Control tests showed that the fat was also formed from sugar-free meat broth and sugar-free meat extract broth containing Witte peptone; therefore, it could not have been formed from sugar. During the growth of the bacillus the medium becomes very alkaline owing to the presence of free ammonia, which is obviously split off from the proteids. It seems probable, according to the authors, that the fat is formed at any rate in part by the oxidation of the fragments of the albumoses and peptones apart from any carbohydrate nucleus which they may contain.

"That it is an oxidation process appears more than likely from the fact that the crystals are formed solely in the surface pellicle. Again under anaerobic conditions the bacilli grow sparingly, and no trace of pellicle or fat crystals is formed."

In addition to the fats a considerable amount of mucin-like substance was formed during the bacterial growth. This gave some of the mucin reactions, yet only traces of a reducing substance could be detected. "Since the mucinous substance, therefore, does not appear to call for any carbohydrate, we may relegate all of the carbohydrate nuclei of the albumoses to the formation of the fat; but even so . . . there could not be sufficient to account for all of it."

The calcium content of different animal organs, M. TOYONAGA (*Bul. Col. Agr., Tokyo Imp. Univ., 6 (1904), No. 2, pp. 89-96*).—The author reports results of analyses, and summarizes the results of other investigators. The occurrence of calcium in different animal tissues and its relation to magnesium is discussed.

ANIMAL PRODUCTION.

Animal breeding and feeding investigations by the Bureau of Animal Industry, D. E. Salmon (*U. S. Dept. Agr. Yearbook, 1904, pp. 527–538, pl. 1*).—The investigations undertaken under the auspices of the Bureau of Animal Industry in breeding sheep, poultry, and horses, the studies of animal nutrition, and of beef and pork production under southern conditions are described, and plans for future work outlined. A considerable proportion of the work referred to has been undertaken in cooperation with agricultural experiment stations.

Fodders and feeding stuffs, F. T. Shutt (*Canada Expt. Farms Rpts. 1904, pp. 166–182*).—Analyses are reported of fodder corn grown in hills and drills, including dent and flint varieties, rape, rape silage, rape and corn silage, mangels, carrots, turnips, and sugar beets, linseed cake, gluten feed, cotton-seed meal, "Uveco" and "Flakerine" (both made apparently by flaking steamed or partially cooked Indian corn), meat meals for poultry, pea meal, pea dust, ground pea bran, barley feed, meal seeds, oat dust, spoiled raisins (with a view to learning their value as poultry feed), ground seeds (largely weed seeds, screenings, etc.), and a commercial mixed feed.

The percentage composition of the rape silage was: Water 78.19, protein 2.67, fat 0.84, nitrogen free extract 12.93, crude fiber 2.00, and ash 3.37; and of rape and corn silage 1 : 1, water 79.66, protein 2.18, fat 0.37, nitrogen-free extract 10.40, crude fiber 5.29, and ash 2.10.

The rape silage contained 1.36 per cent albuminoid and 1.31 per cent non-albuminoid nitrogen; the rape and corn silage 1.04 and 1.14 per cent, and the rape 1.30 and 0.61 per cent, respectively.

"The observed increase in the non-albuminoids and the concomitant decrease in the albuminoids that has followed upon ensiling the rape marks the most important change in the composition of the dry matter of the rape. This in conjunction with the destruction of a part of the carbohydrates necessarily increases the percentages of the fiber and ash. The changes are such as might have been expected and indicate a certain deterioration in the silo of the dry matter of the rape."

Commercial feeding stuffs (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. 385–437*).—This is a reprint of Bulletin 147 of the station (E. S. R., 16, p. 903).

Commercial feeding stuffs, J. L. Hills, C. H. Jones, and F. M. Hollister (*Vermont Sta. Bul. 109, pp. 8*).—Under the provisions of the State feeding stuff law, a number of samples were examined, including cotton-seed meal, linseed meal, gluten meals and feeds, dried distillers' grains, oat feeds, hominy chop and similar goods, provenders (corn and oat products), and wheat offals.

In discussing the feeding stuffs sold in the State, the results of five years' work are taken into account. "No material change in the average grade of the richer concentrates [now sold] appears, save in the gluten meals. This improvement, however, is due to an alteration in a manufacturer's process rather than to any direct effect of inspection. The by-products of the oatmeal mills have been quite decidedly upgraded, and farmers are less inclined than formerly to regard a liberal showing of oat hulls in a provender as a guaranty of excellence." As in past years, some of the corn and oat provenders contained too large a percentage of oat hulls.

Regarding the success which has followed the passing of a feeding stuff law, the authors state that "five years ago guaranties were few and far between. To-day they are in general use, and, while too often disregarded, or, indeed, misinterpreted, they are at once protective and educative."

The data presented in a comparison of the amount of protein furnished by different classes of concentrated feeds, as compared with their cost, shows that cotton-seed, linseed, and gluten meals, and dried distillers' grains rank highest and low-grade oat feeds lowest of the materials considered.

Commercial feeding stuffs, J. L. HILLS, C. H. JONES, and F. M. HOLLISTER (*Vermont Sta. Bul. 110, pp. 11-20*).—In addition to the analysis of 250 samples of commercial feeding stuffs in connection with the inspection, some microscopical examinations were also made.

The feeding stuffs included cotton-seed meal, linseed meal, gluten meals and feeds, dried distillers' grains, oat feed, hominy chop and similar products, provenders, wheat offals, mixed feeds, malt sprouts, ground malt, hay feed, proprietary feeds, meat meal, and calf meal.

During the year attention was directed especially to the collection of samples of wheat offals, more particularly the so-called mixed feeds, as well as unlabeled and unidentified brans and middlings. The grade of such feeds "appears to be worse this fall than at any time since the law went into effect. It behooves buyers more than ever before to be judicious in their purchases, particularly of wheat offals, lest they buy goods laden with ground corn cobs or other offal, oat hulls, clippings, or the like."

Sugar in the feeding of animals, E. CUROT (*Le sucre dans l'alimentation des animaux. Paris: L. Lavaur, 1905, pp. 380; rev. in Rev. Sci.* [*Paris*], *5. ser., 3* (*1905*), *No. 14, pp. 429-431*).—A summary and discussion of data on the importance of sugar as a feeding stuff.

The cattle industry in Germany and elsewhere, J. HANSEN and A. HERMES (*Die Rindviehzucht im In- und Auslande. Leipsic: R. C. Schmidt & Co., 1905, vols. 1 and 2; abs. in Vrtljschr. Bayer. Landw. Rat., 10* (*1905*), *No. 2, pp. 242, 243*).—The condition of the cattle industry in different countries, methods followed to build up the industry, and related questions are taken up in these volumes.

Feeding trials, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 128, pp. 304-307*).—Two feeding trials were made at the Fort Hays Branch Station.

In the first trial the comparative value of corn, barley, and wheat with alfalfa hay, corn with sorghum hay, prairie hay and oat straw, and mixed grains and mixed hays for the production of baby beef, was tested with 7 lots of 8 calves 8 to 10 months old, the feeding period covering 182 days. All the calves were fed at first a ration of a pound of grain and ten pounds of coarse fodder, the grain being increased and the coarse fodder correspondingly decreased until they were given all they would eat up clean.

The average daily gains ranged from 1.23 lbs. per head on corn and sorghum hay to 1.85 lbs. on corn and alfalfa hay, the grain required per lb. of gain ranging from 4.04 lbs. on a wheat and alfalfa hay ration to 7.17 lbs. on corn and oat straw. The smallest amount of coarse fodder per lb. of gain, 3.54 lbs., was also noted with the last ration, and the largest gain, 5.92 lbs., with the corn and sorghum hay ration. The estimated profit per lot ranged from $27.09 with the lot fed corn and sorghum hay, to $109.74 with the lot fed corn and alfalfa hay.

"There was a more marked difference in the appearance of the lots than the results show, though the rank would be in the same order as the daily gains. The alfalfa lots fed much more evenly than the sorghum, straw, or prairie-hay fed lots." An account was kept of the cost of labor involved in caring for the cattle and grinding their feed. On an average it amounted to 2 cents per head per day.

In the second test pencillaria stover and Kafir-corn stover were compared with two lots of 8 cows each. The pencillaria was somewhat overripe when cut, and part of the crop had been irrigated. The Kafir-corn stover was of fair quality. In the 22 days of the test there was an average gain of 6.9 lbs. per head on the Kafir-corn stover, and an average loss of 30 lbs. on the pencillaria stover, the total amounts eaten in the two cases being 4,990 and 2,520 lbs., respectively.

"During the experiment it was easily observed that the cows getting pencillaria were not doing so well, were getting thinner and in poorer condition, but their appetite seemed to be good. However, it is believed that had the experiment been carried longer . . . they would have shown a lack of appetite for the feed, both Kafir corn and pencillaria."

The irrigated pencillaria had large stems and consequently more of it was wasted than was the case with that which was not irrigated.

Beef production, J. H. Grisdale (*Canada Expt. Farms Rpts. 1904, pp. 61–70*).—In studying the relative merits of different methods of handling steers, it was found that a lot of eight three-year-olds loose in their stalls made an average daily gain of 2.28 lbs. at a cost of 5.22 cts. per pound in a test covering 129 days. With a similar lot of two-year-olds the average values were 2.53 lbs. and 4.3 cts. Three-year-olds and two-year-olds tied (9 in a lot) made an average daily gain of 2.12 and 2.15 lbs. respectively, the cost of a pound of gain being 5.59 cts. and 5.16 cts. The results "are decidedly in favor of loose box feeding."

When the cost of producing beef from 3-year-olds, 2-year-olds, yearlings, 6-months calves, and new-born calves was studied, it was found that the average daily gain in the 129 days of the test ranged from 1.68 lbs. with the new-born calves to 2.53 lbs. with the two-year-old steers, and the cost of a pound of gain from 2.77 cts. with the new-born calves to 5.62 cts. with yearling steers. All the lots were fed roots, silage, and hay. In addition the calves were given a mixed grain ration and the other lots gluten meal.

Data are also briefly reported regarding the feeding of 2 lots of 5 yearlings and two lots of 6 steer calves each for the production of baby beef on fattening and on limited rations, the feeding period with the first mentioned lots covering a year and with the others 214 days. On a fattening ration, the yearlings made an average daily gain of 1.65 lbs. per head at a cost of 3.59 cts. per lb. and the calves of 1.68 lbs. at a cost of 2.77 cts. per lb. Similar values for the yearlings on a limited ration were 1.06 lbs. and 3.3 cts. and for the steers 1.58 lbs. and 2.83 cts.

As regards the feeding value of a commercial sugar beet pulp containing molasses, the author states that it has been found particularly valuable for feeding young stock and beef animals on account of its palatability and the fact that it stimulates appetite. When fed to dairy cows in excess of the normal meal ration or as replacing a part of it, the feeding value was low, being equal to about half that of a like quantity of bran. Fed in the same way to two and three year old steers it had about the same comparative value, but improved the appearance of the cattle, "giving them a sleek look scarcely attainable otherwise."

A test is reported in which the value of this molasses beet-pulp feed was tested as a substitute for coarse fodder (roots and silage).

When a lot of three steers was fed a ration of 8 pounds of molasses feed and an equal quantity of silage roots and straw, the average daily gain was 2.47 lbs. per head and the cost of a pound of gain 3.38 cts. When 12 lbs. of the molasses feed was fed with 4 lbs. of straw to a similar lot, the average daily gain per head was 1.87 lbs. and the cost of a pound of gain 5.15 cts. On a ration of silage, roots, and straw only, similar values for a like lot were 2 lbs. and 2.35 cts.

Brief statements are made regarding the value of "Uveco," a commercial feed apparently consisting of steamed corn, flaked and dried. It was found that 2 steers receiving this feed exclusively as a grain ration gained 1.4 lbs. per head per day for a period covering 45 days.

"The meat from these steers was of very excellent quality, due in some measure no doubt to the good quality of the food fed. So far as gains are concerned, it will of course be noted that much larger daily gains were quite possible."

Experiments with steers, R. Robertson, S. A. Bedford, and A. Mackay (*Canada Expt. Farms Rpts. 1904, pp. 341–348, 390–392, 446–449*).—At the Maritime Provinces Farm, the relative merits of feeding steers loose and tied in stalls was tested in continuation of earlier work (E. S. R., 16, p. 292), with two lots of 8 dehorned steers fed like rations. The loose steers made a total gain of 2,325 lbs. and those which were tied of 2,125 lbs. in 165 days. With all the steers, the average profit was calculated to be $2.97 per head.

In a comparison of the relative value of full fattening rations and limited growing rations, it was found that five calves fed a limited growing ration for 180 days made an average daily gain of 1.52 lbs. at a cost of 6.15 cts. per lb.

In a second test, five calves continued on a full fattening ration until finished for market (120 days) made an average daily gain of 1.68 lbs. per head at a cost of 8.16 cts. per lb. Five similar animals fed a limited growing ration, in a year made an average daily gain of 0.97 lb. per head, the cost of a pound of gain being 6.48 cts. With five other steer calves, the average daily gain was 1.05 lbs. per head and the cost of a pound of gain 6.35 cts. for a like period.

In a fourth test, which was begun with 5 calves on a full fattening ration, the average daily gain in 180 days was 1.9 lbs. at a cost of 6.49 cts. per pound as compared with 1.51 lbs. and 5.27 cts. in the case of a like number fed a limited growing ration for 183 days.

At the Manitoba Experimental Farm the relative gains made by 6 yearlings and 6 two-year-old steers fed similar rations were tested. In the 16 weeks of the test the yearling steers made a total gain of 1,152 lbs. and the 2-year-olds of 1,170 lbs., the profit per steer in the two lots being $1.85 and $2.23, respectively.

At the Indian Head Farm the gains made by young and old steers was also studied. Eight animals a year and a half old at the beginning made a total gain of 1,220 lbs. in the 16 weeks of the test proper as compared with 2,040 lbs. in case of an equal number of steers two and a half years old. The calculated profits per head in the two lots were $6.15 and $5.00, respectively.

In connection with the tests brief notes are given regarding the cattle kept at the several experimental farms.

Sheep breeding experiments (*Field Expts. Staffordshire and Shropshire and Harper-Adams Agr. Col., Joint Rpt. 1904, pp. 11, 12*).—Continuing the college sheep-breeding experiments, 3 lots of 25 Welsh ewes each were crossed with Welsh, Southdown, and Shropshire rams.

The lambs dropped ranged from 25 with the Shropshire to 29 with the pure-bred Welsh. In the test as a whole the best results, the author states, were obtained with the Welsh lambs. "This is principally due to the larger proportion of lambs reared and sold." At birth the Welsh lambs were hardier and withstood adverse weather conditions better than the others and were ready for slaughtering nearly 3 weeks earlier.

Sheep and swine, W. Dinsmore (*Iowa Agr., 5 (1905), No. 9, pp. 292–298, figs. 7*).—Different methods of cutting pigs are described and data given regarding slaughter tests made in connection with class-room work. The author points out that lambs of moderate weight produce carcasses with a higher percentage of lean meat than older wethers and that such carcasses are more choice, if the lambs have been properly finished.

"In beef, pork, and mutton the percentage of flesh element is the determining factor in deciding the value. We must produce this flesh element by selecting sire and dams that possess it; and must avoid fattening mature animals for too long a period, as this results in waste."

Pork production, J. H. Grisdale (*Canada Expt. Farms Rpts. 1904, pp. 70–74*).—It was found to cost about 25 per cent more to maintain brood sows in good condition in small board cabins than in a regular run or house. Young pigs wintered indoors made slightly larger and considerably cheaper gains than pigs wintered outdoors.

Several mixed rations were tested with pigs fed inside and outside, without an abundance of skim milk or whey. With pigs fed outside without skim milk, equal parts of shorts and gluten meal, and shorts and linseed meal, 4:1, both gave satisfactory results; but the addition of some skim milk cheapened the rations considerably. Similar lots fed indoors gave much better results, the rate of gain being

slightly increased and the cost of production lowered. The most satisfactory grain mixture was shorts and linseed meal, 4:1.

The value of a number of stock foods for pork production was tested, using 8 lots of 4 pigs each, the test covering 90 days. The list included International Stock Food, Anglo-Saxon Stock Food, Herbageum, and sugar and flax. A grain mixture composed of half shorts and half oats, peas, and barley, fed in connection with skim milk or pasturage, was the cheapest. All the stock feeds had the effect of raising the cost of production.

With Uveco, which is apparently made by passing cooked or steamed Indian corn between rollers, the gain was somewhat larger than on shorts and oats, and the cost cheaper. "The food was evidently very palatable, as the pigs ate it with avidity."

Large Blacks have been tested as to their value for pork production for several years, with the following results: "As prolific and healthy breeding stock they can not be surpassed by any of the breeds now commonly bred in Canada. As pigs for crossing they are exceedingly impressive, whether male or female, and leave their mark stamped very distinctly, no matter what the other cross may be. The cross-breds have also been uniformly healthy and quick feeders, the cross with the Tamworth being particularly remarkable in this respect. As pure-bred pigs they have been found to be rapid and easy fatteners, exceedingly good grass or pasture pigs, and have stood all kinds of weather without any apparent evil effects. As pigs for bacon production, however, they have proven to be a complete failure."

Experiments with swine, R. Robertson, S. A. Bedford, and A. Mackay (*Canada Expt. Farms Rpts. 1904, pp. 348, 349, 392, 393, 449, 450*).—The relative merits of feeding in pasture and in pens were studied with 2 lots of 10 pigs each, the rations being essentially the same for both lots. In the 153 days of the test, the total gain made by the pigs fed most of the time in pasture was 1,439 lbs. and by those fed in pens 1,287 lbs., the cost of a pound of gain in the two cases being 3.55 cts. and 3.94 cts.

At the Manitoba Experimental Farm ground barley was compared with ground mixed grain (wheat, oats, and barley 1:1:1). In the 70 days of the test, four pigs fed barley made a total gain of 254 lbs. A similar lot fed the mixed grain gained 205 lbs., the profit in the two cases being $7.85 and $5.52, respectively. "The pen fed on barley consumed 40 lbs. more grain during the fattening period than those fed on mixed grain."

Ten pigs pastured on an acre of nearly ripe peas gained 277 lbs. in 47 days.

At the Indian Head Experimental Farm a test was made of rape pasturage supplemented by a small amount of meal. In three months seventeen pigs made an average gain of 26.5 lbs. per head. Only about two-thirds of the rape on the half acre on which they were pastured was eaten. As shown by a comparative test, the yield of rape was 32 tons to the acre. The growth was quite rank and the pigs did not eat large amounts at first, and they seemed always hungry until their meal ration was increased.

Some data are also given regarding the pigs kept at the several experimental farms.

Experiments with swine, M. Cumming (*Ann. Rpt Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 97-101*).—In a comparison of large and small amounts of blood meal and tankage with skim milk as part of a ration, and with meal alone, made with 8 lots of 4 pigs each, it was found that the greatest gain, 597 lbs., was made by a lot fed tankage, meal, and skim milk, 1:15:13, and the smallest gain, 461 lbs., by a lot fed blood meal and meal, 1:14.

The cost of a pound of gain ranged from 3.48 cts. on a ration of tankage and meal 1:15 to 4.23 cts on blood meal and meal 1:9. The test began June 27 and closed Nov. 23. All the lots received uniform treatment and were given some green feed and roots in addition to the other feeds mentioned. According to the author, the pigs fed on meal alone made very satisfactory gains but not as large as those made

by the other groups. Considering both the rate and cost of gain the skim milk and meal ration was rated highest, and the ration containing a large amount of blood meal with meal lowest.

"Blood meal, mainly on account of its extra cost, proved the least satisfactory of these supplemental foods. Tankage proved much more satisfactory and, while not quite equal to skim milk, yet, when fed in small quantities along with a small quantity of skim milk, gave about the best results."

"Judging from this, we would say that tankage would prove itself an excellent food to add to a ration for pigs when only a limited amount of skim milk was available, which is often the case on the average farm. In both cases where tankage and blood meal were fed in different proportions, the smaller proportion proved more satisfactory. This is about what we would expect in considering the nature of the main meal ration, viz, middlings, barley, and oats. Had the ration consisted of a large amount of corn, it is very likely that the larger amount of these by-products would have proved more satisfactory."

In a test of the value of pasturage, two lots of 1[illegible]gs were pastured for five weeks on clover and then for ten weeks on rape—one lot being fed all the grain they would eat up clean and the other about two-thirds as much. After the period on pasture, both lots were fed in pens for seven weeks on roots and a full meal ration. The total gains made during the test as a whole by the lot on a heavy ration was 1,334 lbs., and and by those fed a light ration, 1,339 lbs. While on pasturage, the two lots required respectively 4.21 and 3.53 lbs. of meal per pound of gain. Considering the test as a whole, the amounts required were 5.17 and 4.45 lbs. and the cost of meal per pound of gain 4.65 cts. and 4 cts.

"The importance of carefully husbanding the grain fed to pigs on pasture is strongly emphasized in this experiment. At the time the pigs went inside, the light feed ones were considerably thinner than the heavy ones, but they had developed just as big frames and went ahead more rapidly during the last stages of feeding, at which time they, too, were fed a full ration."

Soy beans and rape were compared with two lots of 6 pigs each, fed like rations of meal and skim milk in addition to the green feed. About 5 lbs. of soy beans and about 5.5 lbs. of rape was eaten per head per day. In the five weeks of the test, the total gain on rape was 145 lbs. and on soy beans 159 lbs.

"It is evident that the soy beans are a richer food than rape, a lesser quantity producing a greater gain. On the other hand, rape is a heavier yielder per acre than soy beans. From this it is evident that, for purposes of feeding green forage to pigs in pens, a given amount of land might be equally profitably sown with either soy beans or rape. When, however, it is desired to pasture pigs on one or the other crop, rape will stand the tramping, etc., much better, and is the more profitable crop."

Canadian and Danish bacon, G. E. DAY (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 89-96*).—On the basis of personal observations, the author discussed the market qualities of Danish and Canadian bacon with a view to suggesting methods of improving the Canadian product. The Danish bacon is of superior quality and the bulk of it comes from crossbred pigs fed largely on barley though other grains including corn are sometimes used. The pigs are not given any considerable amount of exercise.

Some notes are given regarding the crops raised at the Ontario Experimental Farm and also regarding the feeding of cattle and pigs and experiments with live stock. The work with pigs has been summarized in another publication (E. S. R., 15, p. 69).

Horses, J. H. GRISDALE (*Canada Expt. Farms Rpts. 1904, pp. 44-47*).—Some data are given regarding the cost of the feeding and care of the station farm horses and the work required of them, and feeding tests are reported. Using 6 lots of

2 horses each, different mixtures of bran, oats, and oil meal were compared with oats to determine whether a mixed grain ration could replace oats to any considerable degree with advantage.

An average of about 20 pounds of grain was fed per head per day, with about 17 pounds of oat hay. In the 40 days of the test, losses in weight were noted on all the rations except bran and oats, 1:1, apparently owing to the fact that the oat hay was not well liked.

As regards the relative economy of the rations, the author calculated that, except in the case of the ration of oil meal and oats 1:10 which cost $1.25 per year more than oats alone, substituting a mixed ration for oats would effect an annual saving ranging from $2.92 with bran, oil meal, and oats 2:1:10 to $19.53 on bran and oats 2:1.

The ration of bran and oats 2:1 "may be recommended as a good meal ration for working horses and is certainly very economical in comparison with pure oats." The ration of bran, oil meal, and oats 2:1:10 "would be considered by most horsemen as an ideal ration." At the close of the period, timothy hay was substituted for oat hay and in every case the horses gained in weight.

In a comparison of roots and silage, horses fed turnips in addition to oats, bran, and hay maintained their weight while the lots fed carrots, mangels, and silage, respectively, lost somewhat in the 14 days covered by the test. A check lot fed oats, hay, and bran only gained somewhat in weight.

The average amount of silage fed was 10 pounds and of roots 6 to 10 pounds per head per day. The average amounts of meal and hay were 18 and 15 pounds, respectively. According to the author, when such amounts of roots and silage are fed to work horses, the results are not very favorable as the succulent feeds are laxative in character.

As regards palatability the turnips and carrots were most relished, with silage almost as welcome, and mangels not at all in favor.

"It was observed that fed in smaller amounts per day or fed to idle horses no evil effects were noticeable. The roots or silage did not seem to replace any of the regular ration of meal and hay, and the feeding of these feeds was an added expense rather than an economy.

"Where fed to idle horses, however, or where fed to horses it was desired to put in better condition, a small amount of roots—5 to 8 pounds per day—has been found beneficial, as serving to prevent digestion troubles."

Report of the poultry manager, A. G. GILBERT (*Canada Expt. Farms Rpts. 1904, pp. 283–311, pl. 1*).—Factors of especial interest with respect to poultry production are discussed and data given regarding the effects of introducing superior breeding stock into the Station flock, the stock on hand, the poultry exhibit at the Central Canada Fair, the time of laying of pullets and old hens, the management of the Station poultry, poultry diseases and similar topics, together with some details of experimental work.

As regards the effect of variety "experience has shown that where there is variety in rations and care in feeding them, with requisite allowance for floor space, there is little likelihood of egg eating or feather picking."

Steamed lawn clippings were fed to the Station poultry stock three or four times a week and eaten with evident relish. "It is a very beneficial way of utilizing a form of waste. Clover leaves treated in the same way are equally effective."

The eggs laid by different breeds ranged in weight from 4.5 lbs. per dozen with ordinary brown Leghorns to 13.75 lbs with selected Buff Orpingtons.

In the 5 or 6 months of a test of different cheap grain mixtures the largest number of eggs was obtained with nine pullets fed twice a day a ration of 0.75 lb. of oats and wheat 2:1 with roots. The smallest number of eggs was obtained with a similar lot fed mangels with a like amount of the same grain mixture and a lot fed beets with a ration of 0.75 lb. of wheat and oats 2.1.

Continuing the studies of the cause of weak germs in early spring eggs (E. S. R., 16, p. 296), it was found that hens kept in cold quarters and fed heavily produced eggs with strong germs which hatched well. On the other hand, poultry kept in artificially warmed houses laid eggs with weak germs which hatched weak chicks. The "results were considered in favor of fresh air and plenty of it even if it was cold."

Data are recorded regarding hatching tests, to compare different sorts of incubators with hens, but definite deductions are not drawn.

In a study of the duration of fertilization after the removal of the male bird, records were kept of the number of eggs laid and the eggs which hatched or which were shown to be fertile. The last trace of fertility was noticed eleven days after separation. In accord with earlier observations, the unfertilized eggs had superior keeping qualities, so the author recommends that as a rule male birds should not be kept with hens depended upon for market eggs.

A test was also reported made by F. T. Shutt, in which chickens and old hens were compared, some of the chickens being fed in pens with limited runs and others in crates. The hens were fed in pens. The average gain per head per week in the month covered by the trial ranged from 4.4 lbs. with old hens to 7.1 lbs with chickens fed in pens. In general the chickens fed in pens made greater gains than those fed in crates. It was also true that the chickens fed a mixture containing meat meal made greater gains than similar lots fed a ration without this form of animal feed.

Considering the test as a whole, the cost of a pound of gain ranged from 4.3 cts. with one of the lots of old hens to 6.1 cts. with one of the lots of chickens fed in crates. The deductions which were drawn from the test follow:

"The pullets, with one exception, did not make as great gains as cockerels of the same age. Old hens which are well fed require no further treatment to make them fit for killing. The older the hen the more readily does she take on fat rather than flesh. The crossbred chicken, although fed on a more nutritive ration, did not make as much weight as pure-bred ones. The chickens which were loose in their pens with limited runs made slightly greater weight development, at cheaper cost, than those in crates."

Poultry, R. Robertson, S. A. Bedford, and A. Mackay (*Canada Expt. Farms Rpts. 1904, pp. 350, 393, 394, 450*).—Data are given regarding the poultry kept at the Maritime Provinces, Manitoba and Indian Head Experimental Farms, and tests carried on at the Manitoba Farm are also briefly reported.

Four pure-bred Plymouth Rock cockerels fed all they would eat of a mixture of equal parts of ground wheat, oats, and barley mixed to a thin porridge with skim milk gained 6 lbs. in 21 days at a cost of 3.25 cts. per lb., as compared with 5 lbs. 2 oz. at a cost of 3.5 cts. per lb. in the case of four white Wyandottes fed the same ration. (For earlier work see E. S. R., 16, p. 296.)

An incubator test led to the following conclusions: "The percentage of chickens from fertile eggs was the same, whether setting hens or incubator were used. It is possible to secure earlier chickens by using an incubator. A large proportion of the eggs laid in early spring before the fowls have an opportunity to take exercise are not fertile."

Poultry, W. R. Graham (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 135–141, fig. 1*).—Statements are made regarding early and late hatching, the Station poultry houses, the treatment of breeding stock, varieties of geese kept, etc. In a test, which began in July, of the possibilities of inducing early moulting, it was found that in general old hens confined and fed a low ration for two weeks and then an abundant ration began to moult during the third week of the test, while those fed the same way but allowed to range did not. This would indicate, according to the author, that it is possible to control the moulting season more or less.

In a test of the value of skim milk, animal meal, beef scrap, and blood meal as part of a ration, made with 7 lots of 12 chickens each, the greatest gain, 16.5 lbs., was made in 2 weeks with a lot fed grain and skim milk and the smallest gain, 9 lbs., by a lot fed grain and animal meal. The cost of a pound of gain ranged from 3.9 cts. with a lot fed grain and skim milk to 7.3 cts. with a lot fed grain and beef scrap. According to the author, the skim milk substitutes tend to produce yellowish flesh, while skim milk is one of the best feeds for producing white flesh.

To test individuality data were recorded regarding the gains made in three weeks by 12 chickens, and were found to vary in amount from 1 lb. 1 oz. to 2 lbs. 1 oz. All the chickens were selected from a flock which would be considered of fair average quality.

Distribution and magnitude of the poultry and egg industry, G. F. THOMPSON (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 73, pp. 22, fig. 1*).—An abridgment of a previous publication (E. S. R., 15, p. 502).

The early development of guinea eggs, I. TUR (*Abs. in Physiol. Russe, 3 (1904), Nos. 48–60, pp. 208, 209*).—The fact that guinea eggs require 4 weeks for incubation, as compared with 3 weeks in the case of hens' eggs, led the author to undertake the studies reported of the changes which take place in the early part of the incubation period.

Judging of the animal body by photogrammetric methods, E. LIEBENAU (*Mitt. Landw. Inst. Leipzig, 1905, No. 6, pp. 1–60, pls. 21*).—The use of photographic methods in judging of the animal body are spoken of, the different methods employed, accuracy, and related questions being considered.

DAIRY FARMING—DAIRYING—AGROTECHNY.

Report of the professor of dairy husbandry, H. H. DEAN (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 73–88*).—Brief notes are given on the work of the dairy department during the year, and experiments in cheese making, butter making, and feeding cows, many of which are in continuation of previous work (E. S. R., 15, p. 1110), are reported.

Experiments in cheese making (pp. 74–81).—A comparison was made of pepsin and rennet for coagulating milk in cheese making. One ounce of pepsin was dissolved in 20 oz. of water and 6¾ oz. of this solution was used per 1,000 lbs. of milk. Rennet extract was used at the rate of 3½ oz. per 1,000 lbs. of milk. Eight comparative tests were made during the month of August. When rennet was used the average yield of marketable cheese per 1,000 lbs. of milk was 91.6 lbs. and when pepsin was used 91.1 lbs. The average of all scorings for flavor was 35.5 out of 40 for the rennet cheese and 35.8 for the pepsin cheese. The average total scores were, respectively, 90.7 and 91.1. Mention is made of the greater difficulty in preparing the pepsin solution for use.

Comparisons were made of cheese containing normal and excessive amounts of moisture. In one series the percentage of moisture was 57.377 at the time of dipping, 42.438 at the time of milling, and 35.979 in the green cheese, while in the normal series the percentages were, respectively, 54.431, 40.965, and 34.571. The acidity was also higher at the time of milling and salting in the cheese containing excessive moisture.

The increased yield of marketable cheese in the first series amounted to about ½ lb. per 1,000 lbs. of milk. "There was little difference in the quality of the cheese. From 2 years' experiments we may conclude that an excess of 1 to 2 per cent moisture may be left in cheese ripened in cold storage without much danger of the quality deteriorating, although the normal cheese scored slightly better."

In 7 experiments comparisons were made of 3½ and 6¾ oz. of rennet per 1,000 lbs. of milk, the cheese being ripened in one series in mechanical cold storage at about

40° F. and in another in ice cold storage at the same temperature. There was little or no difference in the yield and quality of the cheese whether a normal or a larger amount of rennet was used. Cheese ripened in mechanical cold storage lost more in weight than cheese ripened in ice cold storage, but averaged slightly better in quality. It is believed that an excessive amount of rennet may be used with safety where cheese makers desire the cheese to ripen more rapidly after placing in cold storage.

Placing cheese on shelves and boxing directly from the press were again compared in a number of experiments. The cheese in boxes lost less in weight than cheese placed on shelves. There was practically no difference in the quality of the cheese treated by the 2 methods. The cheese in boxes, however, showed a greater tendency to mold. Boxing cheese directly from the press is believed to be quite practicable.

Comparative tests were made of ripening cheese in mechanical cold storage at average temperatures of 31.7, 39.3, and 42°; ice cold storage at 41.2°, and in a cellar at 51.4°. There was not much difference in the quality of the different lots of cheese. The higher the temperature the greater was the loss in shrinkage.

Ice cold storage and mechanical cold storage were compared in experiments in which the cheese was moved from the ordinary ripening room to cold storage at the end of 1 week. There was practically no difference in the quality of the cheese whether placed directly in cold storage or at the end of 1 week. The shrinkage was greater in the latter case and also greater in mechanical cold storage than in ice cold storage.

Experiments in butter making (pp. 81-85).—In 4 experiments in butter making pasteurizing milk was compared with pasteurizing cream. While the experiments are not considered sufficient in number to warrant positive conclusions, the results are considered as indicating that when first made there is little or no difference in the quality of butter in summer whether the whole milk or cream is pasteurized, but that the butter holds its flavor slightly better when made from pasteurized milk as compared with pasteurized cream. It is thought probable that the extra labor involved in cleaning the separator bowl when separating pasteurized milk counterbalances any difference in quality.

Churning sweet cream to which 27½ per cent of butter culture had been added was compared with churning ripened cream. The yield of sweet cream butter was slightly less, though the quality was superior not only when first made but at later periods. A comparison was also made of churning sweet cream without the addition of culture and similar cream to which from 20 to 30 per cent of culture had been added. There was less loss of fat in the buttermilk when the culture was used and the flavor of the butter was also better.

The results of several tests failed to show any advantage in using dry parchment paper as compared with moist paper for wrapping pound prints of butter. The value of formalin as a preventive of mold on butter is considered doubtful.

Several experiments were made in the cold storage of butter. Mechanical cold storage at about 40° F gave slightly better results than ice cold storage at the same temperature. A temperature of 28° gave better results than a temperature of 40°. None of the July butter was suitable for table use when examined at the end of November. It is therefore not believed to be possible to hold butter in cold storage for 3 or 4 months and have it retain its fine flavor.

Feeding experiments (pp. 85, 86).—Tests were made of 2 proprietary stock foods. Blatchford's Sugar and Flaxseed Meal increased slightly the yield of milk, but not sufficient, in the opinion of the author, to warrant the additional expense. The results of a calf feeding experiment were considered favorable to the use of this material as a food for calves.

The Improved Molasses Cattle Food, a by-product from the beet-sugar factory, was tested with 21 cows with results indicating, in the opinion of the author, that this

material will prove a valuable addition to the foods available for the production of milk.

Dairy herd record (pp. 86–88).—Records are given of the dairy herd of 24 cows for 1 year. The yield of the individual cows ranged from 9,161 lbs. of milk to 2,515 lbs., and the profit on milk from $117.77 to $22.41.

Dairy school bulletin (*Ontario Agr. Col. and Expt. Farm Bul. 143, pp. 56, figs. 5*).—This bulletin has been prepared by the staff of the dairy school of the Ontario Agricultural College, and contains introductory notes by H. H. Dean on dairy stables, feeding cows, digestible nutrients in feeding stuffs, paying patrons, and other topics, and the following articles: The Alkaline Solution—Its Preparation and Use, by R. Harcourt; Milk and Cream Testing, by J. A. McFeeters; Hints on the Care of Milk for Creameries and Cheese Factories, and Canadian Cheddar Cheese Making, by W. Waddell and A. McKay; Separators and the Separation of Milk, by R. W. Stratton; Creamery Butter Making, by C. W. McDougall; Hand Separators, by G. R. Taylor, and Farm Butter Making, by Laura Rose.

The dairy produce act of Queensland, 1904.—Instruction to dairymen, G. S. Thomson (*Queensland Agr. Jour., 15 (1905), Nos. 7, pp. 826–832; 8, pp. 879–887, pls. 15, fig. 1*).—The chief provisions of this law are noted and instructions are given on milking and on the handling of milk and cream with a view of enabling dairymen to comply with the requirements of the act. Some experiments on aeration and cooling are briefly reported. Numerous illustrations are given of plate cultures inoculated in various ways.

Cleanliness in dairy management, J. F. Blackshaw (*Jour. Bd. Agr. [London], 12 (1905), No. 3, pp. 136–144, figs. 6*).—The importance of cleanliness in dairying is emphasized in this discussion and illustrations from photographs are given showing the appearance of plates exposed in badly ventilated and well ventilated stables, exposed under dirty and clean cows, and inoculated with milk drawn into dirty and clean pails.

Experiments with dairy cows, J. H. Grisdale (*Canada Expt. Farms Rpts. 1904, pp. 54–61*).—Tabulated data are given for several feeding experiments.

A ration containing mangels was practically no better for milk production than one containing about the same quantity of silage but was more expensive. The results of a comparison of dry and succulent forage showed the greater value of the latter in maintaining the yield of milk. Comparative tests were also made of silage, sugar beets, sugar mangels, and turnips. The turnips were more expensive than the other feeding stuffs and not so effective. They also imparted a bad flavor to the butter, rendering it quite unsalable. The best results so far as the yield of milk was concerned were obtained by the sugar beets.

Feeding cows twice a day was found as effective as feeding three times a day. A test was made of the feeding value of refuse apples for cows. From the data obtained it is estimated that the apples were worth $2.40 per ton or about 7 cts. per bushel as compared with roots and silage at $2 per ton. The cows seemed to relish the apples and made considerable gains in live weight.

Dairy herd records, J. H. Grisdale, R. Robertson, and S. A. Bedford (*Canada Expt. Farms Rpts. 1904, pp. 47–54, 339, 340, 390*).—Records are given of 28 cows of different breeds at the Central Experimental Farm, 21 cows at the Experimental Farm for the Maritime Provinces, and of 7 cows at the Experimental Farm for Manitoba. Notes are also given on the feeding of the cows at the 2 farms first mentioned.

Tests of Guernsey cows for advanced registry (*Connecticut State Sta. Rpt. 1904, pt. 5, p. 460*).—Yearly tests of 15 cows admitted to advanced registry are reported. Tests of 2 other cows are also noted.

Experiments in aseptic milking, V. Willem and A. Miele (*Rev. Gén. Lait, 4 (1905), No. 18, pp. 409–419*).—In the series of 35 experiments here reported, great precautions were taken to prevent the contamination of milk during milking. The

milk was bottled, cooled, and shipped by railroad to the laboratory where bacteriological examinations were made after intervals averaging 39 hours. The number of bacteria found in the different samples ranged from 8 to 356 and averaged 102.

The results were essentially the same whether the milk was from 1 cow or was the mixed milk of several cows. The samples remained sweet at least 10 days, more often 17 to 20 days, and occasionally 2 to 3 months at a temperature of 13 to 15° C. Lactic-acid bacteria developed over the peptonizing forms and finally produced coagulation of the milk. It is believed that as good results may be obtained in the future in ordinary practice.

The milking machine, P. H. SUTER (*Jour. Dept. Agr. So. Aust., 8 (1905), No. 11, pp. 658–661, figs. 3*).—A favorable report is made upon the Lawrence-Kennedy milking machine, which it is stated is becoming quite extensively used in Australia. The advantages and disadvantages of the machine are briefly discussed. Its use is not considered profitable with herds of less than 30 cows.

Effect of the heat of cows on the composition of milk, G. FASCETTI (*Rev. Gén. Lait, 4 (1905), No. 17, pp. 385–388*).—On the basis of observations made with 2 cows the author concludes that during estrum the yield of milk is slightly decreased while the percentages of fat, total solids, and proteids show a tendency to increase. The variations from the normal were not very marked.

Influence of food on the quality of milk, C. QUILLARD (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 1, pp. 112, 113*).—The author discusses briefly the unsuitability of certain feeding stuffs for cows which are used in the production of milk for infants, and concludes from the results of his studies that sugar-beet pulp except when dried has injurious effects.

Observations on the milk of cows in Jamaica, H. H. COUSINS (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 6, pp. 118–122*).—The average composition of the milk of 92 Jamaica cows was as follows: Specific gravity 1.028, total solids 13.83 per cent, fat 5.1, solids-not-fat 8.69, and ash 0.70. The highest percentage of fat was 8.7 and the lowest 2.9. The Holstein breed is believed to be unsuited to Jamaica conditions. Of 14 samples of market milk collected in Kingston 6 were certified as adulterated with water.

Report on the milk of Jamaica cows, H. S. HAMMOND (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 6, pp. 122–127*).—This gives the detailed analytical data upon which the above discussion is based.

Average composition of the milk of sheep in Southern Sardinia, A. SANNA (*Staz. Sper. Agr. Ital., 38 (1905), No. 4, pp. 289–306*).—The average composition of 55 samples from one locality was as follows: Specific gravity 1.0385, total solids 18.13 per cent, fat 7.53, casein 4.65, albumin 1.01, sugar 4.05, and ash 0.89.

The average composition of 15 samples from different localities analyzed in 1900 was as follows: Specific gravity 1.0376, total solids 18.34 per cent, fat 7.29, casein 4.60, albumin 1, sugar 4.23, and ash 0.96. The average composition of 62 samples from different localities examined in 1901 was as follows: Specific gravity 1.0381, total solids 17.79 per cent, fat 6.64, casein 4, albumin 1.03, sugar 4.85, and ash 0.91.

On the nature of the cellular elements in human colostrum and milk, V. WALLICH and C. LEVADITI (*Ann. Inst. Pasteur, 19 (1905), No. 5, pp. 321–334, pl. 1*).—The results of morphological studies and inoculation experiments with guinea pigs are reported.

The cellular elements in human milk were found to vary under different conditions. When lactation was suddenly terminated mononuclear but more especially polynuclear leucocytes appeared in large numbers. The colostrum corpuscles were believed to have two sources, one epithelial or glandular and one mesodermic. When milk was injected into the peritoneal cavity of a guinea pig cellular elements were later observed which had the appearance of colostrum bodies and which were believed to have arisen from the phagocytes.

Leucocytes in milk and their significance, C. F. DOANE (*Maryland Sta. Bul. 102, pp. 205–223*).—The author calls attention to the absence of definite knowledge concerning the milk of diseased cows, describes a method devised at the station for determining the number of leucocytes in milk, gives the results of numerous leucocyte counts, reports studies of the occurrence of fibrin in normal and diseased milk, and concludes that the presence of clumps of fibrin and leucocytes in milk is a proof that such milk came from a diseased udder.

The Doane-Buckley method of determining the number of leucocytes in milk as well as some comparisons of this method with the older one of W. R. Stokes have already been noted (E. S. R., 16, p. 617). The author counted the leucocytes in the milk of the station herd and found that in a large number of samples the numbers ranged from 3,000 to 1,600,000 per cubic centimeter. Even greater variations were observed in the milk of individual cows of a large and well kept private herd. In no instance in either herd was the milk free from leucocytes.

Several tests were also made of the milk from the different quarters of the udder, the lowest number of leucocytes recorded being 1,000 per cubic centimeter. These observations are believed to show quite conclusively that leucocytes are never absent from milk, and that with most cows their numbers run into the thousands per cubic centimeter. No significance is attached to even considerable variations.

It is not believed that the mere presence of leucocytes in the milk necessarily means an inflamed area in the udder, but that the leucocytes may escape normally from the blood into the milk. However, when inflammation was evidently present the number of leucocytes was large. The adoption of some definite number of leucocytes as a standard for indicating the presence of pus in milk is therefore believed to be by itself arbitrary and unreliable.

While studying the characteristics of pus the author observed threads identified as fibrin. These were found to be most satisfactorily stained by using Delafield's hematoxylin, to which 15 per cent of carbolic acid had been added, and counter staining with eosin. Such threads were also found in milk and when present in any quantity large numbers of leucocytes were found collected in masses. "There can be little doubt that these leucocyte masses or clumps furnish the most practical and the easiest means of determining the presence of pus and the healthfulness of the milk."

When the number of leucocytes is low the presence of clumps need not be expected, but when the number is high search should be made for them. "The presence of fibrin, as shown by clumps of leucocytes in the blood counter, or as demonstrated by stained threads, combined with an abnormal number of leucocytes, is the only satisfactory proof that inflammation exists in the udder. Without the fibrin any serious inflammation is to be doubted."

Contrary to statements that the milk of cows once affected with garget is never again fit for use, tests by the author's method failed to show that milk after such attacks is always unwholesome.

Reference is made to the work of Babcock on the occurrence of fibrin as a natural constituent of milk (E. S. R., 1, p. 162), which the author believes has not heretofore been established, but which can be demonstrated microscopically in suitable preparations.

Experiments with Fliegel's apparatus for determining dirt in milk, J. KLEIN (*Milchw. Zentbl., 1 (1905), No. 7, pp. 305–307*).—The milk is filtered through a layer of cotton previously dried at 100°. The cotton filter is then washed successively with water, alcohol, and ether, and again dried to a constant weight, the difference in the 2 weighings representing the amount of insoluble impurities in the milk. Several determinations are reported. The method is considered more satisfactory than the others which have been devised for this purpose.

Examination of Babcock test apparatus (*Connecticut State Sta. Rpt. 1904, pt. 5, p. 448*).—Of 151 pieces of glass apparatus tested in 1904 only 1 was found inaccurate.

Milk consumption in Lille, A. BONN (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 1, p. 114*).—The total daily consumption of milk in the city of Lille is estimated at 32,590 liters, of which skim milk constitutes 20,440 liters. The average fat content of the whole milk was 3.08 per cent and of the skim milk 1.61 per cent. The large infant mortality in Lille is attributed in part to this unusually large consumption of skim milk.

Cooperative dairying in England, H. C. FAIRFAX-CHOLMELEY (*Jour. Bd. Agr. [London], 12 (1905), No. 4, pp. 193-201*).—A brief account is given of the actual working of one of the dairies. There are in all 14 cooperative societies.

Milk depots in Germany, VON OHLEN (*Pub. Health [London], 17 (1905), No. 10, pp. 655-663*).—This is an account of the milk depots in Germany with special reference to the conditions in Hamburg.

The addition of formalin to milk, H. DE ROTHSCHILD (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 1, pp. 110-112*).—This is a brief preliminary note on experiments conducted to determine the physiological effects of formalin. Milk preserved with formalin in the proportion of 1 to 10,000 produced bad effects when fed to infants affected with gastro-enteritis. Experiments are also being conducted with dogs in which, by means of a gastric fistula, the effect of formalin upon digestion is being studied.

Investigations on the presence of tubercle bacilli in milk, butter, and margarin in Christiania, H. THUE (*Tidskr. Norske Laegefor., 1904, No. 8, p. 306; abs. in Centbl. Bakt. [etc.], 1. Abt. Ref., 36 (1905), No. 18-20, p. 597*).—In no instance in the 44 samples of market milk, 16 of butter, and 15 of margarin examined were virulent tubercle bacilli found.

On the pasteurization of milk in the feeding of infants, E. VON FREUDENREICH (*Rev. Gén. Lait, 4 (1905), No. 19, pp. 433-437*).—This is a description of a pasteurizing apparatus devised by the author and O. Jensen.

Pasteurization of milk for infants, ZELEŃSKI (*Abs. in Deut. Med. Wchnschr., 31 (1905), No. 29, p. 1167*).—On the basis of extended investigations the author concludes that the present methods of pasteurization are not free from objections.

Influence of heat on milk, E. KAYSER (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 2, pp. 147-153*).—This is a discussion of the changes brought about in milk by the influence of different degrees of heat.

On the value of a good separator, with brief descriptions of different systems, E. FREUND (*Maschinen Ztg., 3 (1905), Nos. 10, pp. 109-117, figs. 37; 11, pp. 127-132*).—This is an illustrated description of the different types of centrifugal separators.

Butter preservatives, H. H. DEAN and R. HARCOURT (*Ontario Agr. Col. and Expt. Farm Bul. 145, pp. 18*).—The use of preservatives in food is briefly discussed, references being made particularly to Bulletin 84 of the Bureau of Chemistry of this Department (E. S. R., 16, p. 684), and to the report of the British committee (E. S. R., 13, p. 1070).

In a test at the college 12 men consumed daily a total quantity of about 3 lbs. of butter preserved with ½ per cent of borax. No injurious effects were observed by the men during a first period of 26 days or a second period of 50 days. This experiment is therefore considered as tending to prove the conclusion arrived at by the British committee. It is nevertheless considered unwise to recommend the use of preservatives except in cases where the necessity is clearly manifest and where other methods of preservation can be demonstrated as inapplicable.

Numerous comparative tests were made of salt, borax, boric acid, sodium chlorid, and commercial preparations as regards their efficiency in preserving the flavor of butter.

Borax gave practically as good results as the commercial preservatives. Under ordinary conditions ½ per cent is considered sufficient, but when the butter is likely

to be held for over 3 months or subjected to high temperatures ½ per cent may be added. Butter made from sweet cream was preserved better than that made from ripened cream. Salt was more effective in preventing mold than the other preservatives.

"At the present time we are not prepared to recommend the use of milk or cream preservatives.

"For the home trade, with proper means for pasteurizing the cream and suitable cold-storage facilities, we do not consider that preservatives, other than salt, are needed to keep butter for a reasonable length of time.

"For the export trade which allows one-half of one per cent boracic acid in butter it would seem as if this amount might be used to advantage in some cases, but with suitable cold storage and especially where pasteurization is followed, less than this amount would preserve the butter and be less liable to injure the consumer.

"Salicylic acid, sodium fluorid, and formalin may not be recommended as butter preservatives. The first one is more or less harmful, and gives an objectionable flavor to butter, while the latter two are considered quite harmful to the human system."

Notes on abnormal butters, L. HOTON (*Abs. in Rev. Gén. Lait, 4 (1905), No. 17, pp. 398–404*).—Variations in the composition of butter are discussed, and studies on the solubility of glycerids in acetic acid with experiments on the critical temperature of butter fat in the same acid are reported.

The value of the different determinations (Reichert-Meissl number, soluble acids, volatile insoluble acids, critical temperature in alcohol or Crismer index, critical temperature in acetic acid or Valenti index, Hubl number, Hehner number, and the index of refraction) in detecting adulteration is discussed. It is stated that some Holland butters, pure but abnormal in composition, can not always be distinguished from adulterated samples.

Experiments on the manufacture of Parmesan cheese with pure cultures of bacteria, F. SAMARANI (*Milchw. Zentbl., 1 (1905), No. 6, pp. 251, 252*).—The results of experiments conducted in 1903 and 1904 were considered very favorable to the use of Gorini's pure cultures in the manufacture of Parmesan cheese.

Micro-organisms in the cheese industry, P. MAZE (*Ann. Inst. Pasteur, 19 (1905), No. 6, pp. 378–403*).—Part 1 of this quite full discussion of the subject deals with molds and part 2 with lactic-acid bacteria.

Twenty-eighth annual meeting of the Iowa State Dairy Association (*Iowa Yearbook Agr. 1904, pt. 4, pp. 199–323*).—This report of the proceedings contains the score in detail of the butter exhibit at the Iowa State Dairy Convention held in February, 1905, and articles on the care of milk on the farm, value of silos, value of corn for milk production, qualifications of a good butter maker, pasteurization of hand-separator cream, breeding up the dairy herd, and other subjects.

Missouri State Dairy Association (*Ann. Rpt. Mo. Bd. Agr., 37 (1904), pp. 267–337, pl. 1, fig. 1*).—This is a summarized account of the proceedings of the fifteenth annual meeting of the association, held in February, 1905. Among the several articles in this report is one entitled The Farmer's Dairy Cow, by A. J. Glover, which contains the results of farm tests of 10 dairy herds in Illinois. The average yield of milk for all the herds was 4,944 lbs. the first year tested and 5,611 lbs the second year. The average fat content for the 2 years was, respectively, 4.06 and 4.07 per cent.

United States and State standards for dairy products, 1905 (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 74, pp. 2*).—This gives in tabular form the standards for dairy products as proclaimed by the Secretary of Agriculture and as established by law in the several States, and is a revision of Circular 49 of the Bureau (E. S. R., 16, p. 601).

Manufacture of dry wines in hot countries, F. T. BIOLETTI (*California Sta. Bul. 167, pp. 67, figs. 17*).—Methods for improving the manufacture of dry wines in

hot climates are discussed under the headings of (1) amelioration of the character of the raw material and (2) the control of fermentation.

Under the first heading are considered the suitability of varieties of grapes, methods of culture, time of gathering grapes, the more complete utilization of the substances in grapes, and the addition of substances deficient in grapes or not normally present, and under the second heading modifying the temperature of fermentation by cooling devices, postponement of fermentation until winter and the transportation of grapes or must to a cool locality, and controlling the kind of fermentative agents present by sterilization and the use of pure and selected yeasts.

While the bulletin is based upon observations made by the author in a visit to some of the chief vine-growing regions of Europe and Algeria, it contains also some experimental work conducted in California.

"The main lesson of immediate practical importance to California wine makers to be learned from these observations and experiments is the oft-repeated one of cool fermentation." The experiments at the station have shown that good, sound dry wines can be made from grapes grown on rich irrigated soils in central California. So far such wines have not been made successfully.

The following method is believed to offer an almost practical certainty of attaining this object: "(1) Heating the crushed grapes to a temperature and for a time sufficient to extract the necessary color, tannin, and body; (2) immediate separation of the must and cooling to 85° F.; (3) immediate fermentation of the must at a temperature not exceeding 90° F." This method is not recommended for immediate introduction; but in view of the results that have been obtained when working with small quantities in California and of its successful employment in France it is considered very desirable that the method should be given a thorough trial.

Contribution to the study of wine making in Algeria, J. BERTRAND (*Bul. Agr. Algérie et Tunisie, 11* (*1905*), *No. 13, pp. 285-292*).—Notes are given on wine making in Algeria, and experiments in the manufacture of both red and white wines are reported.

Orange wine, PAIRAULT (*Bol. Cámara Com. Asunción, Paraguay, 1904, No. 15* (*Abs. in Mo. Consular Rpts.* [*U. S.*], *1904, No. 289, pp. 69, 70*).—The author has made a special study of fermentation as applied to the production of orange wine.

The usual way of making orange wine in the Antilles is to peel the oranges, press out the juice, add sugar to it, and then place it in a glass or earthenware vessel and subject it to spontaneous fermentation. This fermentation proceeds slowly on account of the low nutrition of the medium in which the yeast works, consequently an acid fermentation sets in and the result is a poor product.

To overcome this difficulty the author states that after the orange juice has been sterilized sufficiently there should be added to every quart of the liquid 12.25 to 14 oz. of sugar, 0.175 oz. of brewer's yeast, and 2 oz. of a mixture made of the following proportions: Ammonium phosphate 30, calcium phosphate 40, potassium bitartrate 40, magnesium sulphate 3. "When the mixture is cooled fermentation proceeds, and in a few days there results an excellent product. A sweet or dry wine may be made by increasing or diminishing the amount of sugar added."

In Consular Reports No. 297, page 9, two corrections to the above article are made. Instead of brewer's yeast it should be "maltopeptone," and "instead of 2 ounces of a mixture of ammonium phosphate, etc., 23 grains should be added."

Review of viticultural reviews, E. H. TWIGHT (*Bul. Cal. Vit. Club, 1905, No. 1, pp. 7-16*).—This number contains about 20 abstracts of articles on wine making appearing in French journals.

Preparation of practically sterile apple must, G. PERRIER (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 5, pp. 324, 325*).—Many methods of sterilizing apple must have been suggested, but for the most part they bring about some undesirable

change in its composition. Experiments have therefore been made during a period of 3 years with formaldehyde to preserve must.

In this work the apples are first washed and then put into a solution of formaldehyde in the proportion of 8 to 1,000 and left there for from 5 to 10 minutes. They are then washed in clean water, and crushed and pressed. The crushing and pressing apparatus is also sterilized with formaldehyde used in the proportion of 4 parts to 1,000. It has been found that the must of apples thus treated does not ferment. Such must was sent from Rennes to Buenos Ayres and back again without any fermentation whatever taking place.

The must thus obtained contains only small traces of formaldehyde, and this disappears at the end of several days. The taste and the composition of the must are identical with that of must prepared from apples which have been subjected to no treatment whatever. When the musts are seeded with yeast they ferment regularly, producing normal cider of high quality containing no traces of formaldehyde.

Directions for the manufacture of olive oil in Algeria, P. DUMAS (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 13, pp. 292-302*).—This is an account of methods employed in olive-oil making in Algeria.

Cotton-seed products, L. L. LAMBORN (*New York: D. Van Nostrand Co., 1904, pp. XIII+240, figs. 79, map 1*).—It is stated that "the purpose of this book is to supply a demand for a treatise on the subject of cotton seed which should deal not only with the extraction of the oil from the seed, but with the utilization of the products of the seed as well. With this purpose in view, this book is submitted to a clientele which includes the technical student, the practical man in the fat and oil industries, the cotton-seed oil miller and, last but in no wise least, the consumer of the products of cotton seed."

Different chapters deal with the cotton plant, the cotton-seed industry, summary of procedure in utilizing of cotton seed, cotton seed, cotton-seed products, manufacture of oleomargarine and lard compound, manufacture of soap and soap powder, cotton-seed meal and cotton-seed hulls for cattle food and fertilizer, and rules for the government of transactions in cotton-seed products.

Reports of the Twelfth Census and publications of this Department were drawn on in the preparation of the book.

VETERINARY MEDICINE.

The evolution of immunity, G. R. LEIGHTON (*Jour. Compar. Path. and Ther., 17 (1904), No. 4, pp. 287-295*).—In this article particular attention is given to a discussion of immunity as a problem of heredity.

Several examples are cited of animal and human diseases in which a resistance to the disease is gradually being developed among races which are subject to the infection. The author believes that innate immunity and the power of acquiring immunity to a disease are evolved in the same manner as other characters, and that the whole process is due to natural selection. The prevalence of disease is considered one of the most important factors by which the process of natural selection is influenced.

The fundamental laws of immunity, A. WOLFF (*Centbl. Bakt. [etc.], 1. Abt., Orig., 37 (1904), Nos. 3, pp. 390-397; 4, pp. 566-576; 5, pp. 684-706*).—This is a general article in which the author discusses the nature of toxins, endotoxins, bacteriolysis, agglutination, hemolysin, precipitins, cytotoxins, the relationship of leucocytes to immunity, and other subjects related to this problem.

The intrauterine and extrauterine transmission of antitoxins from mother to offspring, P. H. RÖMER (*Beitr. Expt. Ther., 1905, No. 9, pp. 18-41, pls. 5*).—These experiments were carried out on guinea pigs, rabbits, sheep, cattle, and human beings.

The antitoxins employed were those of tetanus and diphtheria. In guinea pigs and rabbits it was found that no diphtheria antitoxin could be demonstrated in the blood of the young, although the antitoxin was present in the mother's blood at the time of parturition. Similar results were obtained with tetanus antitoxin. In the experiments with cattle and sheep it was shown definitely that the antitoxin could be transmitted in considerable quantities in the milk of the mother. In such cases the amount of antitoxin found in the blood of the young and the amount in the milk of the mother corresponded quite closely.

Annual report on the distribution of animal plagues in the German Empire (*Jahresber. Verbr. Tierseuch. Deut. Reiche, 18 (1903), pp. VI+222, pls. 4*).—As in previous reports, a general account is presented of the health of animals in Germany and of the prevalence of anthrax, black leg, rabies, glanders, foot-and-mouth disease, pleuro-pneumonia, sheep pox, scabies of horses and sheep, swine erysipelas, swine plague, fowl cholera, fowl plague, cerebro-spinal meningitis, influenza of horses, tuberculosis, and trichinosis. The greater portion of the report is occupied with a detailed account of the distribution of these diseases in different parts of the German Empire.

Diseases due to streptococci and their preventive and curative treatment, THOMASSEN (*Rev. Gén. Méd. Vét., 3 (1904), No. 30, pp. 289–302*).—It is believed that in cases of infectious pleuro-pneumonia of horses a streptococcus is associated with the pathogenic pasteurella. Various other diseases of the nature of erysipelas and with similar symptoms are shown to be due to streptococci. Notes are given on the classification of these organisms according to the animal which was affected and according to the nature of the disease produced. In treating the diseases caused by streptococci success has been had in the use of serum. The administration of drugs has not given very satisfactory results except in the case of ichthargan and collargol. The various pathogenic streptococci of man and animals seem to be identical in their pathogenic properties.

Pathogenic mucors and mucormycoses in animals and man, G. J. BARTHELAT (*Thesis, Univ. Paris, 1903, pp. 128, figs. 13*).—In general mycoses may be divided into 2 groups according as they are produced by species of Aspergillus or Mucor.

According to the author's experience, the most virulent species of Mucor are *Mucor corymbifer*, *M. ramosus*, *M. truchisi*, *M. regnieri*, *M. pusillus*, *Rhizomucor parasiticus*, etc. Numerous observations were made on spontaneous cases of mucormycoses affecting different parts of the body of animals and man. As a rule, pathogenic mucors become established more readily in tissues which are already altered in a pathological manner.

The introduction of spores of mucors into the veins of rabbits, guinea pigs, and chickens, causes the death of these animals after a period which varies according to the quantity of spores inoculated. Spontaneous cases of mucormycoses may be advantageously treated by means of arsenic and iodid of potash.

Tuberculosis of cattle, D. E. SALMON and T. SMITH (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 70, pp. 28*).—This is a revision by D. E. Salmon and J. R. Mohler of an article in the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

The frequency of bovine tuberculosis in abattoirs and dairies in the department of Herault, A. CONTE (*Rev. Gén. Méd. Vét., 4 (1904), No. 41, pp. 224–227*).—The official reports in France concerning the prevalence of tuberculosis are believed to be somewhat defective and greater thoroughness along this line is recommended. Certain French races of cattle appear to be greatly afflicted with tuberculosis, infection varying from 9.55 to 35.83 per cent. In one instance 199 out of 518 animals reacted to the tuberculin test.

Experiments concerning tuberculosis, III, E. C. SCHROEDER and W. E. COTTON (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 52, pp. 95–125*).—In continuing their experiments along this line the authors found that numerous injections of attenuated cul-

tures did not give so much protection as a single injection of a more virulent culture. The highest degree of immunity is produced by cultures of a virulence just insufficient to cause progressive tuberculosis. With such cultures subcutaneous injection is as effective as the intravenous method.

An attempt to obtain an antitoxic blood serum from the donkey, mule, and horse by inoculation with tuberculin and attenuated tubercle bacilli was only partly successful. The serum of treated animals appeared to have some antituberculous power.

The persistence of tubercle bacilli in the tissues of animals after injection was studied, especially in cattle. Virulent tubercle bacilli were found in all lesions of whatever age. It appears, therefore, that bacilli may retain their virulence long after they cease to multiply and perhaps indefinitely. Dead bovine tubercle bacilli inoculated into a sheep caused quite extensive disease and persisted in the tissues for nearly 6 months. Tubercle bacilli of such low virulence as to be perfectly innocuous for guinea pigs remained in the tissues of cattle for 10 months. On account of the long persistence of tubercle bacilli in the tissues, the method of immunization by attenuated cultures is condemned as somewhat dangerous to man.

Lesions in the kidneys caused by intravenous inoculation with tubercle bacilli, L. BERNARD and M. SALOMON (*Compt. Rend. Soc. Biol.* [*Paris*], *57* (*1904*), *No. 35, pp. 526–528*).—Five rabbits were inoculated with an emulsion of tubercle bacilli directly into the left ventricle, and also 3 dogs were inoculated intravenously. These animals were killed from 20 days to 3 months after inoculation and the kidneys were studied for the purpose of determining the lesions produced by such infection. These lesions were found to be chiefly of 3 sorts, viz, tuberculous follicles, chains of lymphocytes, and epithelial lesions.

The dangerous properties of tuberculous meat and prophylactic measures, VALLÉE and VILLEJEAN (*Rev. Gén. Méd. Vét.*, *3* (*1904*), *No. 29, pp. 233–245*).—According to the majority of investigators at the present time, tubercle bacilli of bovine origin are the most virulent of all forms of these organisms.

Notes are given on the distribution of tuberculous lesions in adult cattle, calves, sheep, and goats, together with statistics on the relative frequency of the occurrence of this disease in slaughtered animals. The permanent French commission for the study of tuberculosis recommends that tuberculosis of hogs should be added to the list of diseases which must be passed upon by the sanitary police.

The value of the study of tuberculin reaction, S ARLOING (*Jour. Méd. Vét. et Zootech.*, *56* (*1905*), *Jan., pp. 1–5*).—A brief criticism is presented of the recent work of Vallée on the subject of a precocious reaction to a second tuberculin inoculation.

In the author's opinion the rapidity with which reaction to tuberculin manifests itself is not much greater at the second test than at the first test. In 40 cases of cattle and goats experimentally inoculated with tuberculosis and subsequently tested with tuberculin for the first time the maximum temperatures were presented in 2 cases within 2 hours, in 2 cases within 4 hours, in 2 cases within 5 hours, and in 9 cases within 6 hours.

In only 1 case did the maximum temperature occur as late as 14 hours after inoculation. The author suggests, therefore, the desirability of taking the temperatures in all cases much sooner after inoculation with tuberculin than has generally been recommended.

Two ways of treating tuberculosis in herds, H. L. RUSSELL (*Wisconsin Sta. Bul. 126, pp. 15, figs 4*).—In 1 herd of 70 cows, the milk of which was used for city supply, 57 reacted to tuberculin, and of the 57 reactors 32 were so badly affected as to require total condemnation of the carcass. In many the udder was affected. In another herd of 72 animals 69 reacted.

In both these cases negligence and unsanitary surroundings were responsible for the heavy losses and the danger to human health. Notes are given on other instances in which the first case of tuberculosis in a herd was promptly detected by

the tuberculin test and the further spread of the disease thus prevented. The importance of the lesson taught by these examples is pointed out.

Immunization against tuberculosis, P. BAUMGARTEN (*Berlin. Klin. Wchnschr., 42 (1905), No. 3, pp. 55, 56*).—The author carried on a number of experiments in testing serum immunization of calves against tuberculosis. Good results along this line had already been obtained in experiments with guinea pigs and rabbits.

The serum used in the experiments came from an animal which had previously received inoculations of human tubercle bacilli and subsequently virulent bacilli from a case of pearl disease in cattle. The animal used for the production of serum had been repeatedly tested with tuberculin without reaction. For the immunization experiment 3 calves were used about 3 months old. One of these received 82 cc. of bovine immune serum within a period of 16 days. At the end of that period the calf was inoculated with 5 cc. of virulent bovine tubercle bacilli. One of the 3 calves served as a control animal, while the third calf was inoculated with virulent bovine bacilli and also received serum as a curative treatment

The control calf became affected with generalized tuberculosis and showed great emaciation. After slaughter abundant evidence was obtained of general infection. The calf which was treated in a prophylactic manner with immune serum when slaughtered at the same time showed no swelling of the lymphatic glands or other alteration which could be attributed to tuberculosis. In the prescapular-lymphatic gland a few yellowish tubercles were found of doubtful nature. The calf which received immune serum for curative purposes was by no means so seriously affected as the control animal and the results obtained with it indicate that an immune serum may be of considerable value for curative purposes.

Experiments in protective vaccination of cattle against tuberculosis according to the method of von Behring, F. HUTYRA (*Beitr. Expt. Ther., 1905, No. 9, pp. 1–17*).—The experiments reported in this paper were carried out on young cattle which received vaccine according to the method of von Behring. The animals were subsequently subjected to intravenous or subcutaneous injections of virulent bovine tubercle bacilli or such bacilli were added to the food. The results of these experiments are presented in great detail in a tabular form.

The author's experiments agree with those of von Behring in showing that human tubercle bacilli, when injected intravenously into young cattle were capable of conferring upon the cattle a high resistance to virulent cultures of tubercle bacilli. Von Behring's method is considered as based upon a solid foundation. It is suggested that further experiments are desirable for the purpose of learning the duration of immunity produced by this method.

Combating bovine tuberculosis according to the method of von Behring, EBELING (*Berlin. Tierarztl. Wchnschr., 1905, No. 1, pp. 1–5*).—The author's observations along this line were made on 1,100 vaccinated cattle, of which 759 received a second vaccination. The nature and theory of von Behring's method are described, and notes are given on the author's method of procedure in making vaccination. The temperatures of animals are taken morning and evening for 2 days before and for 8 days after vaccination.

Among the 1,126 calves vaccinated by the author, 37 were subsequently slaughtered and carefully examined. Of this number, 36 were absolutely free from tuberculous alterations, while in the one remaining animal slight alterations were observed in the right mediastinal and left bronchial glands. The method of von Behring is recommended as practical and efficient.

Anthrax in cattle, horses, and men, D. E. SALMON and T. SMITH (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 71, pp. 10*).—This is a revision by D. E. Salmon and J. R. Mohler of articles in Special Report on the Diseases of Cattle (E. S. R., 16, p. 708) and in Special Report on the Diseases of the Horse (E. S. R., 15, p. 620).

Alterations in the character of the anthrax bacillus, G. SCAGLIOSI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 37* (*1904*), *No. 5, pp. 649–654*).—Anthrax bacilli and spores have been preserved by the author on sterilized threads since 1894.

The action of diffused light upon the anthrax organism was found to be very slight, even after a lapse of 10 years. The agglutinative action was also little affected. Inoculation experiments showed that the virulence of the bacilli is almost as great as that of fresh cultures. From the author's experiments it appears that changes of temperature are more important than any other factors in modifying the virulence and other characters of anthrax cultures.

Texas fever, or Southern cattle fever, D. E. SALMON and T. SMITH (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 69, pp. 13*).—This is a revision by D. E. Salmon and J. R. Mohler of an article in the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

Texas fever cattle tick: Pasture methods of eradication, H. A. MORGAN (*Tennessee Sta. Bul., Vol. XVIII, No. 1, pp. 10*).—A general account is given of the distribution of the cattle tick, immunity to Texas fever, and the national quarantine. The life history of the tick is carefully described with special reference to methods of its eradication. In eradicating the ticks a pasture rotation system may be used, excluding cattle, horses, and mules from pastures from June to October, inclusive, and thus starving out the ticks, or the feed lot system may be adopted.

Experimental transmission of African coast fever by means of ticks, A. THEILER (*Fortschr. Vet. Hyg., 2* (*1905*), *No. 10, pp. 257–268*).—An elaborate account is presented of the appearance, development, and habits of various ticks which occur in South Africa. Experiments were made to determine the possible agency of these ticks in different stages in transmitting African coast fever.

In these experiments *Rhipicephalus decoloratus*, *R. simus*, *R. appendiculatus*, *R. evertsi*, and *Hyalomma ægyptium* were used. From a result of the author's experiments it is concluded that African coast fever is transmitted by *Rhipicephalus appendiculatus* and *R. simus*. The first species is the most important, and adult ticks, of which the nymphs sucked virulent blood, are chiefly concerned in carrying infection. The other species of ticks may be disregarded, with the possible exception of *Amblyomma hebræum*, with which the author made no experiments.

It appears that a tick can produce infection only once. African coast fever is to be expected throughout South Africa wherever the intermediate host of *Piroplasma parvum* is found.

Some diseases complicating rinderpest among cattle of India, J. D. E. HOLMES (*Jour. Compar. Path. and Ther., 17* (*1904*), *No. 4, pp. 317–326, pl. 1*).—As a rule, rinderpest runs a regular course and offers little difficulty in diagnosis. It is often complicated, however, by the simultaneous occurrence of Texas fever, trypanosomiasis, echinococcus disease, distomatosis, or foot-and-mouth disease. Notes are given on the symptoms and pathological anatomy observed in such cases.

The prophylactic treatment of rinderpest by means of preventive inoculation, more especially in the conditions prevailing in India, G. K. WALKER (*Jour. Compar. Path. and Ther., 17* (*1904*), *No. 4, pp. 326–343*).—Considerable difficulty has been experienced in inducing the natives of India to apply any curative or preventive remedies against rinderpest. The disease is enzootic in India, and the mortality is not as high as that observed in South Africa and elsewhere. The virulence of the disease is greatest during the cold season, particularly at the commencement of an outbreak.

The various methods used in treating this disease are carefully outlined and their advantages and disadvantages are described. These methods include Koch's bile method, the glycerin bile method of Edington, the use of a mixture of bile from different sources, the use of serum alone, and the method of simultaneous inoculation

of serum and virulent blood. The advantages of the serum method are that it affords immediate and full immunity and may cure the disease if applied during the period of incubation. The serum may be stored and kept ready for use. It may also be readily transported in bottles. Only one inoculation is required and there is practical certainty of securing good results if proper care is taken.

Notwithstanding the many good points of various methods of treatment, it is believed by the author that there is still room for improvement in the practical and safe treatment of rinderpest.

Inflammation of the udder in cows, M. G. DE BRUIN (*Schweiz. Arch. Tierheilk., 47 (1905), No. 1, pp. 12–24*).—The literature relating to this subject is briefly discussed. Notes are given on a number of different forms of inflammatory conditions of the udder. These conditions may be due to streptococci, tubercle bacilli, and other causes.

In preventing the development of infectious mastitis it is recommended that the straw or litter be furnished in a clean condition, that the cows' tails be prevented from coming into contact with the filth, and that particular attention be given to the feeding and management of cows for the purpose of preventing contamination with bacteria. Attention should also be given to the health of the attendants and to the temporary exclusion from the herd of all animals suffering from the retention of the afterbirth, mastitis, wounds, and other diseases in the case of which bacteria might gain entrance to the milk.

Diseases of the stomach and bowels of cattle, A. J. MURRAY (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 68, pp. 10*).—This is a revision by L. Pearson of an article in the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

Intestinal coccidiosis of young cattle, L. DEGOIX (*Rev. Gén. Méd. Vét., 3 (1904), No. 28, pp. 177–186, figs. 8*).—This disease is also known under the names hemorrhagic enteritis, bloody dysentery, etc.

The first noticeable symptom is the sudden appearance of dysentery with a slight fever, the appetite is lost, and rumination ceases. Emaciation takes place rapidly, and is accompanied with considerable fever during the latter stages of the disease. The duration of the disease is from 5 to 10 days, when recovery or death takes place. In favorable cases recovery takes place rapidly. The author made a study of coccidia in the alimentary tract of affected cattle. These organisms were never found in the epithelial cells of the mucous layer of the intestines, but rather in the deeper lying tissue.

The pathological lesions of the disease were found throughout the whole extent of the large intestines. The organism is described in detail. In controlling this disease the author recommends the disinfection of excrement from diseased cattle and the administration of salol, creolin, or other substances as intestinal disinfectants.

Abortion, or slinking the calf, J. LAW (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 67, pp. 11*).—This is reprinted from the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

Osteomalacia, or creeps, in cattle, J. R. MOHLER (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 66, pp. 2*).—This is reprinted from the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

Ophthalmia in cattle, M. R. TRUMBOWER (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 65, pp. 2*).—This is a revision by L. Pearson of an article in the Special Report on the Diseases of Cattle (E. S. R., 16, p. 708).

Cattle poisoned by fresh paint, E. H. JENKINS (*Connecticut State Sta. Rpt. 1904, pt. 5, p. 448*).—Mention is made of the poisoning of 2 cows by paint which had been consumed with the grass upon which the paint had been spilled, or licked from freshly painted boards.

The symptoms and development of experimental sheep pox, F. J. BOSC (*Rev. Gén. Méd. Vét., 4 (1904), Nos. 42, pp. 273–283; 43, pp. 337–348*).—In the author's

experiments lambs were selected about 4 months of age and coming from herds which were free from the disease. These animals were inoculated cutaneously, subcutaneously, and also into the peritoneum and trachea. The period of incubation and symptoms of the disease from these various forms of inoculation were studied, and a general classification is presented of the symptoms which assist in the diagnosis of the disease and the determination of the period of its development.

Serum treatment of sheep pox, F. J. Bosc (*Compt. Rend. Soc. Biol.* [*Paris*], *57* (*1904*), *No. 37, pp. 647–649*).—During the author's investigation of this disease a study was made of the action of various mixtures of virus and the serum of hyperimmunized animals in treating sheep pox.

The curative action of the mixture of virus and the serum was practically nil. Its preventive action, however, was striking. The technique of this treatment is comparatively simple. Animals are inoculated with virulent virus in the ear. Subsequently a hypodermic injection of 10 to 15 cc. of the serum of hyperimmunized animals is given. This method yielded excellent results, not only in the laboratory but also in field work under unfavorable conditions.

New facts concerning the etiology of hog cholera, E. A. de Schweinitz and M. Dorset (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 72, pp. 157–162*).—This is reprinted from the Twentieth Annual Report of the Bureau of Animal Industry, 1903 (E. S. R., 16, p. 724).

Glanders, J. McFadyean (*Jour. Compar. Path. and Ther., 17* (*1904*), *No. 4, pp. 295–317*).—A historical statement is given concerning the exact knowledge of the nature of glanders. The glanders bacillus is described, and notes are given on its behavior upon different culture media.

Particular attention is given to an account of the methods of infection of glanders. The author succeeded in artificially infecting 4 horses with glanders by adding glanders bacilli to the feed. Detailed notes are given on the distribution of the glanderous lesions in these 4 cases. As a result of this study it is believed that ingestion may be the common natural method of infection with glanders. This belief is at least strengthened by the evidence which the author presents, showing that the lesions in spontaneous cases of glanders and in those due to artificial infection through the alimentary tract are very similar.

The etiology of contagious pleuro-pneumonia and related diseases in the horse, M. G. Tartakovski (*Arch. Vet. Nauk* [*St. Petersb.*], *34* (*1904*), *Nos. 10, pp. 765–787; 11, pp. 875–933, figs. 8*).—The literature of this disease is critically discussed in connection with bibliographical references.

The author carried out numerous experiments in the treatment of the disease, with especial reference to the determination of its etiology. As a result of these experiments it is concluded that contagious pleuro-pneumonia of horses is a specific disease belonging to the group of hemorrhagic septicemia. It closely resembles, in many respects, swine plague and septicemia of rabbits. It usually occurs in the form of an epizootic and may be complicated with a number of other diseases. All affected animals should be closely quarantined, and exposed animals should be given serum treatment.

The forms of pneumonia in the horse, V. Drouin (*Rev. Gén. Méd. Vét., 5* (*1905*), *No. 49, pp. 1–16*).—Statistical data are presented showing the number of deaths in horses from pneumonia from 1897 to 1903, as well as the percentage of pneumonia among the total number of deaths in horses during the same period. The various forms of traumatic and infectious pneumonia are described in considerable detail with notes on the usual methods of treatment.

The trypanosoma of dourine and its life history, A. Lingard (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 37* (*1904*), *No. 4, pp. 537–547*).—This organism varies in size according to the age of the parasite. The disease is transmitted chiefly during

coitus. The cutaneous plaques or nettle-rash eruptions which appear during the course of this disease are described in detail. The trypanosomes are always found in connection with the plaques.

The biology of trypanosomes of nagana and mal de caderas, W. L. JAKIMOFF (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 37* (*1904*), *No. 5, pp. 668-678*).—The author discusses in a detailed manner the morphology and biology of *Trypanosoma brucei* and *T. elmassiani.*

It was found in inoculation experiments that the trypanosomes of nagana and mal de caderas cause an acute infection in mice and rats which lasts not longer than 1 week. In dogs, foxes, guinea pigs, rabbits, and cats the disease shows a slower course, while in goats it assumes a chronic form. Outside of living animals trypanosomes remain alive and maintain their virulence longest in defibrinated blood at a living temperature. Trypanosomes were found to be exceedingly susceptible to heat and disinfection.

Nagana infection in guinea pigs, MARKL (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 37* (*1904*), *No. 4, pp. 530-537*).—*Trypanosoma brucei* was used in these experiments and was found to produce death after the inoculation of guinea pigs within from 11 to 80 days. Detailed notes are given on a number of cases. The incubation period varied from 3 to 8 days. In almost all cases the progress of the disease appeared to be without striking symptoms, but ultimately death occurred very suddenly.

Trypanosomiasis and tsetse-fly disease in French Guiana, A. LAVERAN (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 2, pp. 75-78*).—Brief notes are given on the distribution of tsetse flies and other biting insects in French Guiana and on the relation between these insects and trypanosomiases.

Equine piroplasmosis or "biliary fever," T. BOWHILL (*Jour. Hyg.* [*Cambridge*], *5* (*1905*), *No. 1, pp. 7-17, pls. 3*).—This disease is of great importance in certain parts of Cape Colony for the reason that recently imported horses may develop an acute and fatal form of the disease. The distribution of the disease is briefly discussed and notes are given on the pathogenic blood parasite which occurs in various forms. Apparently, the range horses of South Africa are somewhat immune to the disease, and the author believes that animals which have recovered from one attack are immune. A number of secondary affections may follow upon the occurrence of the disease.

The diagnosis of rabies, L. LUZZANI (*Ztschr. Hyg. u. Infectionskrank., 49* (*1905*), *No. 2, pp. 305-324*).—During the author's observations and experiments with this disease results were obtained which indicate that Negri's corpuscles may be connected with the etiology of the disease.

The author's observations were made on 179 cases, of which 165 were in dogs, 12 in cats, 1 in a beef animal, and 1 in a horse. Among this number 107 were examined for the presence of the parasite and it was found in 102 cases. The author believes, therefore, that in suspicious cases a positive diagnosis may be reached if the endocellular form of the protozoan is found in the nervous system.

The action of centrifugation of rabies virus, P. REMLINGER (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 1, pp. 27, 28*).—In experiments carried out by the author it was found that emulsions of rabies virus, diluted at the rate of from 1 to 50 and 1 to 100 and maintained in the centrifuge revolving at the rate of 100 times per minute, showed a loss of virulence in the supernatant portion after a period of 1 hour. The virulence in this portion of the material was diminished gradually. The author believes that these experiments show that rabies is due to a micro-organism, but that this organism is probably ultra-microscopic in size.

Fowl plague, E. LECLAINCHE (*Rev. Gén. Méd. Vét., 3* (*1904*), *No. 26, pp. 49-54*).—This disease, which is also called bird pest, belongs with the group of hemorrhagic septicemia. Notes are given on the symptoms, diagnosis, pathological lesions, and

prophylaxis of the disease. In controlling fowl plague, it is recommended that the shipment of living or dead birds from infected localities be absolutely prohibited and that thorough disinfectant measures be put in operation.

RURAL ENGINEERING.

Irrigation work in cooperation with the Office of Experiment Stations, United States Department of Agriculture, 1903 and 1904, J. G. HENRY and O. H. ELLING (*Kansas Sta. Bul. 128, pp. 279-286, 307-315*).—An account is given of prospecting for underground water at the Fort Hays Substation, the sinking of wells, the installation of a 4-in. vertical centrifugal pump, and the utilization of the water supply thus secured in the irrigation of a variety of crops, including corn, Kafir corn, sorghum, potatoes, cabbage, soy beans, cowpeas, mangels, and sugar beets, with observations on the cost of sinking the well and irrigating by this means.

The experiments in 1903 were of a preliminary character and were rendered inconclusive by the heavy rains during the growing season. In 1904 "the irrigation work was considerably extended and good results were obtained. However, it appears that the method of pumping water is too expensive to warrant irrigating the common crops. Potatoes and other vegetables, and perhaps alfalfa, will give profitable returns for irrigation."

Conference on water conservation and irrigation (*Sydney: Gov. Printer, 1905, pp. XXIX+277, maps 3*).—This is an account of the proceedings of a conference of delegates from different parts of New South Wales, called by the prime minister of the colony to consider mainly the legal rights of the colony in the water of the Murray River and its tributaries, particularly with the view to making an effective agreement among the three states interested regarding the utilization of these waters for purposes of water conservation, irrigation, and navigation. The draft of a proposed law covering the case is given.

Water conservation and the equitable distribution of water for irrigation and other purposes, H. G. MCKINNEY (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. V-XIV*).—A brief preliminary discussion of this subject as applied to New South Wales conditions.

Property in water, G. CHAMIER (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. XIV-XXIII*).—A discussion of riparian rights as affecting use of water in irrigation in New South Wales.

Irrigation geologically considered with special reference to the artesian area of New South Wales, E. F. PITTMAN and T. W. E. DAVID (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. CIII-CLIII, pls. 2*).—The present state of knowledge is explained and the desirability of more accurate information is pointed out. A list of papers bearing on the subject, compiled by W. S. Dun, is given.

Artesian water supply, W. G. COX (*Agr. Gaz. N. S. Wales, 16 (1905), No. 3, pp. 253-257, fig. 1*).—The author states that "the mechanical power derivable from the pressure given in the outflow from artesian wells, although it varies in different bores, is a constant mechanical asset, the value of which is little understood in Australia, and its prospective value, when the bores become multiplied over the face of the land, can scarcely be estimated or realized." A statement is given of the pressure and resultant horsepower of a number of artesian wells in New South Wales and Queensland, and the utilization of this power in hydraulic turbines is briefly discussed.

A review of water conservation in New South Wales, L. A. B. WADE (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. LXVI-LXXXV, fig. 1*).

Reservoir outlets, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 9 (1905), No. 20, pp. 638-642, figs. 8*).

Relation of electricity to irrigation works and land development, T. ROOKE (*Jour. and Proc. Roy. Soc. N. S. Wales, Engin. Sect., 37 (1903), pp. XCII–CII*).—The possibilities of the application of electricity in irrigation are discussed, examples of successful use being cited.

Irrigation, R. LUNA (*Heraldo Agr., 4 (1904), No. 12, pp. 10, 11; 5 (1905), Nos. 1, pp. 17, 18, fig. 1; 2, pp. 9, 10, figs. 2; 3, p. 9, fig. 1; 4, pp. 19, 20*).—Notes are given on irrigation in Mexico and other countries.

Filtration of public water supplies, R. W. PRATT (*Ohio Sanit. Bul., 10 (1905), No. 1–3, pp. 65–76*).—Various methods which have been used for this purpose are discussed.

Sewage disposal, G. A. JOHNSON (*Ohio Sanit. Bul., 10 (1905), No. 1–3, pp. 23–38*).—This article contains statements regarding the number and size of sewage purification works in Ohio, the reasons for sewage purification, methods of sewage disposal, including dilution, broad irrigation and sewage farming, intermittent sand filtration, treatment of sewage in coarse-grain beds, and notes on preparatory treatment of sewage and disposal of sludge. The Columbus sewage testing station and the methods used there are described in some detail.

The septic tank for the disposal of sewage, F. T. SHUTT (*Canada Expt. Farms Rpts. 1904, pp. 194–197, fig. 1*).—This system of sewage disposal is described and its installation is explained.

Land disposal of garbage: An opportunity for engineers and contractors (*Engin. News, 53 (1905), No. 14, pp. 367–369*).—The successful experience of the city of St. Louis in disposing of garbage by burial on agricultural lands is described, and the system is commended on account of its simplicity and efficiency. "From the economic point of view, it saves from destruction all the fertilizing elements in the garbage, and would enable barren sandy wastes to be converted into market gardens."

Eleventh annual report of the commissioner of public roads for the year ending October 31, 1904, H. I. BUDD (*Paterson, N. J.: News Printing Co., 1905, pp. 220, pls. 39*).—This report includes statements regarding costs of roads constructed in New Jersey during the year; descriptions of the improved roads; an account of the New Jersey good roads exhibit at the St. Louis Exposition; articles on oiled roads, road maintenance, permanence of roads, meadow roads, bitulithic pavement, and facts and fallacies of road construction and repair; a list of quarries and gravel pits in the State; and appendixes containing forms of specifications, etc., and the text of the State road law approved April 1, 1903, with regulations adopted in accordance with this law.

The campaign for good roads (*Wallaces' Farmer, 30 (1905), No. 15, pp. 544, 545, figs. 11*).—This is in large part a description of King's method of keeping roads in condition by dragging.

Road improvement in South Carolina, P. T. BRODIE (*Clemson Agr. Col. Ext. Work, 1 (1905), No. 1, pp. 18–43, figs. 11*).—A general discussion of this subject illustrated by local examples of road construction, particularly the object lesson road constructed at Clemson Agricultural College.

Practical road building in Madison County, Tennessee, S. C. LANCASTER (*U. S. Dept. Agr. Yearbook 1904, pp. 323–340, pls. 5, figs. 5*).—"The purpose of this article is to give the plain facts relating to the construction, cost, and maintenance of first-class stone roads in a county of west Tennessee, where it was necessary to transport all material by rail; and in order that the reader may be able to comprehend these facts more fully, a few statistics are given regarding area, population, taxable values, etc."

Road building in the far North, C. W. PURINGTON (*Engin. and Min. Jour., 78 (1904), Nos. 21, pp. 828, 829, figs. 4; 22, pp. 869–871, figs. 4*).—Road building in Alaska and the Yukon Territory of Canada is discussed, and work undertaken is described.

A treatise on concrete, plain and reinforced, F. W. TAYLOR and S. E. THOMPSON (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1905, pp. XXXV+585, figs. 176*).

Reinforced concrete (*New York: Engin. News Pub. Co., 1904, pp. X+434, figs. 311*).—Part 1 of this volume deals with Methods of Calculation, by A. W. Buel, and parts 2 and 3 Representative Structures, and Methods of Construction, by C. S. Hill.

The modern asphalt pavement, C. RICHARDSON (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1905, pp. VII+580, figs. 32*).

Lime, cement, and gypsum: Their preparation and use for building, technical, and agricultural purposes, R. TORMIN (*Kalk, Zement und Gips, ihre Bereitung und Anwendung zu bauliche, gewerbliche, und landwirtchaftliche Zwecken. Leipsic: B. F. Voigt, 1905, pp. VIII+188*).

Automobiles and agriculture, FINK (*Deut. Landw. Presse, 32 (1905), No. 29, pp. 254, 255, figs. 5*).

The use of the windmill in draining soils, J. FARCY (*Jour. Agr. Prat., n. ser., 9 (1905), No. 4, pp. 117-122, figs. 4*).

The Griffin mill, F. KRULL (*Ztschr. Angew. Chem., 18 (1905), No. 4, pp. 137-139, fig. 1*).—The construction and operation of this mill are described. The essential feature of the mill is a rotating pestle.

Silo construction, G. N. KNAPP (*Wisconsin Sta. Bul. 125, pp. 92, figs. 44*).—This bulletin describes in detail, with numerous illustrations, the construction of the 7 distinct types of silos in general use in Wisconsin, viz, the King, Gurler, stave, Minneapolis, Christensen, stone, and brick silos. The bulletin deals chiefly with problems in silo construction, but considers such questions as how to fill the silo, how to take silage out, how to prevent freezing, what crop to use for silage, what machinery to use to fill silo, etc., in so far as they have a direct bearing on these problems.

Modern silage methods, T. CHERRY (*Jour. Dept. Agr. Victoria, 3 (1905), No. 1, pp. 29-40, pls. 3, fig. 1*).—This is an illustrated description of methods of building silos, particularly the overground silo, and of machinery and methods used in filling the silo, with brief notes on silage crops and the value of silage as a feeding stuff.

The construction of pigsties (*Bd. Agr. and Fisheries [London], Leaflet 121, pp. 5*).

The evolution of the plow, T. H. FOSTER (*Transvaal Agr. Jour., 3 (1905), No. 10, pp. 232-236*).—A brief history of the development of the plow.

Grading of the experimental plats at the Hawkesbury Agricultural College, C. POTTS (*Agr. Gaz. N. S. Wales, 16 (1905), No. 3, pp. 278-285, figs. 10*).—The methods and implements used in this work are fully described.

An implement for the simultaneous plowing under of manures and subsoiling, E. BIPPART (*Deut. Landw. Presse, 32 (1905), No. 26, pp. 231, 232, fig. 1*).—An implement which plows under manure to a shallow depth and at the same time breaks up the subsoil is described.

Lightning report, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 30 (1904), pp. 23-25*).—A record is given of damage done by lightning to trees of various kinds, animals, and farm buildings during the 4 years 1901-1904. An analysis of the figures shows strong presumptive evidence as to the efficiency of planting trees about farm buildings as a means of protection from lightning. "The planting of trees, such as spruce, elm, or maple, near enough to buildings to protect them, but not so near as to endanger them, is strongly recommended. The trees should be planted at such distance that when full grown their branches will not touch the buildings."

AGRICULTURAL EDUCATION.

Industrial education in schools for rural communities, L. D. HARVEY ET AL. (*Winona, Minn.: Nat. Ed. Assoc., 1905, pp. 92*).—This is a report presented at the meeting of the National Educational Association at Asbury Park, July 3, 1905, by a committee appointed at the Boston meeting of the association in 1903, to investigate and report to the association conclusions as to what should be undertaken in the field of industrial education in schools for rural communities. The members of the committee, which has been continued, are L. D. Harvey, of Wisconsin, chairman; L. H. Bailey, of Cornell University; Alfred Bayliss, of Illinois; W. T. Carrington, of Missouri; and W. M. Hays, of this Department.

The report includes a summary of conclusions regarding industrial education (agriculture, domestic science, and manual training) in rural schools; an argument for such education; a discussion of what in the field of industrial education should be undertaken in rural schools of different grades, namely, one-room rural schools, consolidated schools, rural high schools, and secondary schools of agriculture and domestic economy, with suggestive outlines for courses in nature study and agriculture for elementary and secondary schools, suggestions for eliminating part of the unnecessary work now undertaken in rural schools to make room for industrial subjects and for the training of teachers to give instruction in these subjects, and an account of boys' experiment clubs and other agencies available for cooperation in the development of industrial education.

Information regarding the organization and courses of study of the existing and proposed schools discussed by the committee is given in four appendixes, Appendix A, treating of the Dunn County (Wisconsin) School of Agriculture and Domestic Economy; B, of the Minnesota School of Agriculture; C, of "articulated courses in industrial subjects in the consolidated rural school, the agricultural high school, and the agricultural college, as prepared by W. M. Hays, at the request of the committee;" and D, the syllabus of an elementary course in agriculture, quoted from Circular 60 of this Office.

The general conclusions of the committee are (1) that in existing one-room district schools a limited amount of nature study, elementary agriculture, and hand work for both boys and girls may be undertaken, but that in these schools little can be expected from this work except where enthusiastic and well qualified teachers are in charge; (2) "that in the consolidated school having at least four teachers, one of whom is prepared to teach the elements of agriculture and manual training, and another domestic science, very much more in the field of industrial education may be attempted than in the one-room school, and with far better results;" (3) "that in the township or other distinctively rural high school, and in the village high school attended by a considerable number of pupils from the country" elementary agriculture, domestic science, and other lines of industrial education should be taught by teachers specially prepared for the work; (4) that in view of the success of agricultural or industrial high schools in this country and abroad, such schools should be organized in large numbers in agricultural communities; (5) "that the agricultural colleges and experiment stations have already done much in the formulation of a body of knowledge essential in the field of industrial education, but that more yet remains to be done in putting this body of knowledge into available form for use in elementary and secondary schools, and that effort in this direction should be made a prominent feature in the work of the agricultural colleges of the country;" (6) "that the mastery of such parts of this rapidly developing body of knowledge as is within the capabilities of elementary and secondary school pupils furnishes a mental training unsurpassed in extent and quality by the mastery of any other body of knowledge now regarded as essential in our common school courses and requiring an equal amount of time, and that for utility value it is not equaled by any other

body of knowledge at present acquired through the expenditure of the same amount of time and effort;" (7) that much needs to be done to educate the people in rural communities to see and appreciate the value of industrial education; (8) "that the courses of study in rural schools should be framed with reference to meeting the needs of the children in those communities, and not with reference to preparing a small percentage of these children to enter higher schools whose courses of study are formulated, not to meet the needs of the great majority of those who attend them, but to prepare the remaining small minority to enter some still higher school;" (9) that it is possible and desirable, without detriment to the present school system, to organize for rural people an articulated series of schools from the elementary school to, and including, the agricultural college; (10) that special opportunities and inducements must be offered to teachers to prepare themselves for giving instruction in industrial subjects; (11) that the organization of boys' and girls' clubs, reading courses, granges, and farmers' institutes should be promoted; and (12) that under existing conditions as to the preparation of teachers for this work "any law making mandatory the teaching of the elements of agriculture, manual training, or domestic science in the entire body of rural schools within a State is unwise, in that the lack of correct information and consequent faulty teaching on the part of the great mass of country school-teachers will tend to bring the whole subject into disrepute and cause a reaction which will postpone the proper development of industrial education."

Lady Warwick's farming college for girls, H. SPENDER (*Cent. Mag., 70 (1905), No. 4, pp. 548–553, figs. 4*).—This is a popular account of Lady Warwick's efforts to provide such training for middle class girls in England as will enable them to earn a living from the land.

The school she opened in Reading in 1895 is described as preparing the way for her more commodious farm school at Studley Castle, or Warwick Castle, as it is sometimes called. The latter school was opened in 1901 and has an attendance of about 40 students, who are given both theoretical instruction and practical work in horticulture, dairying, beekeeping, canning, pickling, and other related subjects. The author states that Lady Warwick announces that she will gladly welcome American girls to her school.

Agricultural education in Porto Rico, F. M. PENNOCK (*South. Workman, 34 (1905), No. 8, pp. 433–438, figs. 6*).—The writer, who is director of agriculture in the University of Porto Rico, gives an account of the development of agricultural education in Porto Rico since the close of the Spanish-American War.

The first step in this development was the organization of 19 agricultural schools, 10 of which, owing to failures due largely to lack of trained teachers, have since been discontinued. The remaining 9 schools are now said to be doing successful work. The next step was the organization of the University of Porto Rico, the charter of which provides that an agricultural and mechanical department shall be organized and that this institution shall be the recipient of any funds which the United States Government may appropriate for agricultural and mechanical education under the provisions of the Morrill Act, in case its benefits are extended to Porto Rico.

A farm of 100 acres has been purchased at Rio Piedras for the agricultural department, and here an agricultural school of secondary grade was started in February, 1905, in connection with the normal school of the university. The students devote the morning hours to practical work in the fields and the afternoon hours to class work at the normal school and the agricultural college.

The annual report of the Boston school-garden committee, 1905 (*Boston, 1905, pp. 7, pls. 2, fig. 1*).—This is a report of progress by the committee which has had charge of school-garden work in Boston for 4 years. Children's gardens have been maintained during the past year in connection with 9 schools, and in numerous places throughout the city not connected with schools.

Outlines of nature studies, W. Lochhead (*Ont. Agr. Col. and Expt. Farm Bul. 142, pp. 48*).—This bulletin is published for the use of teachers, and includes suggestive outlines for nature-study work on a large number of common subjects in plant and animal life, weather, water, and soils. A classified list of helpful books in nature study is appended.

Boys' agricultural clubs, D. J. Crosby (*U. S. Dept. Agr. Yearbook 1904, pp. 489–496, pls. 3*).—The author gives a brief account of the origin and progress of boys' agricultural clubs in Illinois, Ohio, Iowa, and Texas, and comments on the influence of this work upon the boys and the other members of the communities in which such clubs have been organized.

Hints for the guidance of exhibitors at school shows (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1904, No. 44, pp. 128–131*).—Directions are given for preparing, exhibiting, and judging over 30 different varieties of vegetables and fruits for school shows.

MISCELLANEOUS.

Yearbook of the Department of Agriculture, 1904 (*U. S. Dept. Agr. Yearbook 1904, pp. 776, pls. 76, figs. 64*).—The Yearbook for 1904 has been prepared on the same general plan followed in previous years. It contains a report of the Secretary on the work of the Department during the year, 31 miscellaneous articles noted elsewhere in this issue, and an appendix consisting of a summary of information on various subjects of agricultural interest.

Report of Connecticut State Station, 1904 (*Connecticut State Sta. Rpt. 1904, pt. 5, pp. XV*).—These pages appended to part 5 of the annual report contain the organization list, an announcement concerning the work of the station, a report of the board of control, a financial statement for the year ended September 30, 1904, and a table of contents to the different parts of the report, which have been noted elsewhere.

Experiments at Fort Hays Branch Station, 1902–1904, J. G. Haney and O. H. Elling (*Kansas Sta. Bul. 128, pp. 251–329, pls. 11*).—This includes a history of the branch station and reports and summaries of experiments along several lines which have been conducted during 2 years. The experimental work is noted elsewhere in this issue.

Seventeenth Annual Report of Tennessee Station, 1904 (*Tennessee Sta. Rpt. 1904, pp. 93–107*).—This contains the organization list; brief reports by the president of the university and the botanist, chemist, dairyman, horticulturist, and librarian of the station; a list of the bulletins issued by the station; and a financial statement for the fiscal year ended June 30, 1904.

Experiment Station Work, XXIX (*U. S. Dept. Agr., Farmers' Bul. 225, pp. 32, figs. 6*).—This number includes articles on the following subjects: Injury by smoke and gases, fertilizer mixtures, flint varieties of corn, buying and judging seed corn, tobacco seed, cowpea seed, treating seed oats for smut, potato culture, tomato growing, influence of feed on milk, protecting cows from flies, experiments with turkeys, mineral matter for chickens, brooder house, American Camembert cheese, and swelling in canned peas.

Proceedings of the second annual reunion of the Ohio State Board of Agriculture; the College of Agriculture, Ohio State University; the farmers' institute lectures of Ohio; and the Ohio Agricultural Experiment Station (*Ohio Sta. Bul. 151, pp. 147–194*) —This contains the addresses and discussions on the various subjects considered at the meeting, which was held at the experiment station in June, 1904.

Consumers' fancies, G. K Holmes (*U. S. Dept. Agr. Yearbook 1904, pp. 417–434*).—The author mentions various whims or fancies of consumers in the purchase of butter, cheese, fruits, meats, and other products. As an illustration, it is mentioned

that for city trade the appearance of an apple is of much more importance than quality. It is believed that farmers should learn the whims and fancies of the markets and endeavor to meet those fancies.

An agricultural tour in British Columbia, F. T. SHUTT (*Canada Expt. Farms Rpts. 1904, pp. 197–203*).—Notes are given on the more important agricultural districts visited by the author in May and June, 1904.

Agricultural development in Argentina, F. W. BICKNELL (*U. S. Dept. Agr. Yearbook 1904, pp. 271–286, pls. 4*).—This is a description of the progress being made along agricultural lines in Argentina.

Agricultural conditions in Argentina, C. D. GIROLA (*An. Min. Agr. Argentina, Secc. Agr. (Agron.), 1 (1904), No. 1, pp. 407, pls. 6, map 1*).—Results of studies with reference to the different crops produced in each of the provinces of the country, together with the various agricultural industries, transportation, ports, markets, colonization, immigration, capital, and credit are presented. The publication discusses in particular the cereals, fruits, forage plants, species of forest trees, oil-producing plants, textile crops, dye plants, and plant diseases.

Agricultural conditions in the Province of Entre Rios, Argentina, E. S. RAÑA (*An. Min. Agr. Argentina, Secc. Agr. (Agron.), 1 (1904), No. 4, pp. 326, figs. 59, maps 7*).—Agricultural conditions in general, and the culture of wheat, flax, corn, forage plants, peanuts, and miscellaneous crops are described. Statistics with reference to agricultural production in the province, and estimates of the cost of producing different crops are given.

State publications on agriculture, C. H. GREATHOUSE (*U. S. Dept. Agr. Yearbook 1904, pp. 521–526*).—This deals with State publications other than those of the experiment stations. Some of the more important series of publications are enumerated and notes are given on the nature of the reports and the distribution of the publications.

Accessions to the Department Library, January–March, 1905 (*U. S. Dept. Agr., Library Bul. 54, pp. 59*).

NOTES.

Arizona Station.—A. E. Vinson has been appointed associate chemist to succeed H. B. Slade, who died in the spring.

Colorado College and Station.—J. A. McLean, a recent graduate of Iowa State College, has been appointed assistant in animal husbandry, vice C. J. Griffith, resigned.

Connecticut State Station.—B. F. Walden has entered the service of the station as assistant to the entomologist, and J. L. Kreider and Edward J. Shanley, assistants in chemistry.

Connecticut Storrs Station.—Arthur W. Dox has been appointed chemist in connection with the cheese investigations which are being conducted in cooperation with the Dairy Division of this Department. A flock of 65 Maltese milch goats, imported by the Bureau of Animal Industry, have been received at the station, where they will be used in experiments in the breeding, feeding, and care of milch goats, in cooperation between the station and the Bureau.

Florida Station.—F. M. Rolfs, botanist and horticulturist, has resigned to accept a position at the Missouri Fruit Station. H. S. Fawcett succeeds F. C. Reimer, resigned, as assistant botanist and horticulturist, and Leonard Haseman has become assistant in zoology and entomology.

Hawaiian Sugar Planters' Station.—This station has recently organized a division of pathology and physiology under the directorship of N. A. Cobb, late pathologist for the department of agriculture of New South Wales. L. Lewton-Brain, late mycologist and agricultural lecturer of the Imperial Department of Agriculture for the West Indies, is assistant director of the new division, and E. M. Grosse assistant. W. E. Chambers, late of the *Agricultural Gazette of New South Wales*, has been appointed general illustrator for experiment station publications.

Idaho Station.—The department of entomology has been discontinued, and the work in that line placed in the hands of the plant pathologist, L. F. Henderson. J. S. Burd, station chemist, has resigned to pursue postgraduate work at Yale University.

Indiana Station.—G. I. Christie, recently of the Iowa Station, has been appointed assistant in the agricultural department, to take part in the extension work in agronomy under the recent State appropriation; and W. A. Cochel, of the Missouri Agricultural College, has been appointed assistant in animal husbandry, also in the State work. R. A. Craig has been appointed veterinarian, vice A. W. Bitting, resigned. H. E. Van Norman has resigned to accept a position in the Pennsylvania State College.

Iowa Station.—E. B. Watson has succeeded G. I. Christie as assistant in soils.

Kentucky College and Station.—The trustees of the college have recently created the position of assistant professor of agriculture and animal husbandry, and have elected J. J. Hooper to the position. Mr. Hooper is a graduate of the Texas Agricultural College and for the past two years has been taking postgraduate work at

the Iowa State College. G. N. Keller, assistant entomologist and botanist, has resigned his position and is now connected with the department of agriculture of Ireland, assisting in housing and curing tobacco.

Louisiana University.—E. L. Jordon, of Madison, Wisconsin, has been elected assistant professor of agriculture, and entered upon his duties with the beginning of the college year.

Maryland College and Station.—B. E. Porter, a graduate of the Iowa State College, has been appointed instructor in animal husbandry. S. B. Shaw, assistant horticulturist in the station, has resigned to accept a position with the Baltimore and Ohio Railroad.

Massachusetts Station.—Albert Parsons, assistant chemist, has resigned to accept a position as assistant superintendent of the Hood Farm, at Lowell, Mass. He is succeeded by F. G. Helyar, of the University of Vermont. Joseph G. Cook, assistant in feeds and feeding, has resigned to become superintendent of a large dairy and vegetable farm in the vicinity of Boston, and is succeeded by R. F. Gaskill, a recent graduate of the college dairy course. E. S. Fulton, assistant chemist, has accepted an appointment in connection with the nutrition investigations at Middletown, Conn., and is succeeded by A. C. Whittier, of the University of Maine.

Michigan College and Station.—Horace W. Norton, assistant in animal husbandry, has resigned to engage in dairy farming at Howell, Michigan.

Minnesota University.—William Robertson, instructor in agricultural physics in the school of agriculture, has been appointed superintendent of the substation at Crookston. He will also have charge of organizing the new agricultural school to be built at that place, provision for which was made by the last legislature.

Missouri University and Station.—Dean and Director H. J. Waters, J. W. Connaway, and C. H. Eckles, who spent last year in Europe on leave of absence, have returned and resumed their respective duties. President R. H. Jesse, B. M. Duggar, and W. L. Howard have been granted leave of absence and will spend the year in study in Europe.

Montana College and Station.—E. P. Tannatt has been appointed professor of civil engineering in the college and irrigation engineer in the station.

Nebraska Station.—George R. Chatburn has been added to the station staff as highway engineer.

Nevada University and Station.—President J. E. Stubbs will be absent on leave for six months, beginning November 1. Dean N. E. Wilson will act as president and director during his absence.

North Carolina Station.—Franklin Sherman, jr., has resigned his position as State entomologist to accept the chair of entomology and zoology in the Ontario Agricultural College. R. S. Woglum, a graduate of Cornell University, has been appointed assistant State entomologist. G. M. MacNider and W. G. Haywood have been added to the station staff as assistant chemists. The State department of agriculture has located a branch station for the fruit and trucking interests at Willard, in Pender County.

Ohio Station.—O. E. Bradfute, president of the board of control, has been transferred by the Governor to the board of trustees of the Ohio State University, and John Courtwright, of Ashville, appointed in his place, D. L. Sampson being elected president of the board. B. E. Carmichael, a graduate of the University of Illinois, has been appointed chief in animal husbandry. The station's exhibits at the Ohio State Fair are attracting more and more attention each year. This year the fair management assigned to the station 2,000 sq. ft. of floor space, which was all occupied, and was constantly crowded with visitors. The station has also made exhibits at several county fairs.

Pennsylvania Station.—Percy W. Flint, of Charleston, South Carolina, has been appointed assistant chemist, vice Arthur W. Clark, resigned.

Rhode Island Station.—M. A. Blake, assistant horticulturist, has resigned to accept a similar position at the Massachusetts Agricultural College, vice George O. Greene, resigned.

Tennessee Station.—The station forces have just finished, in cooperation with the commissioner of agriculture of the State, a campaign of farmers' institute work in western Tennessee. In the general educational campaign now being conducted in east Tennessee, the director has been making addresses upon agricultural education. A new silo and a modern manure shed with cement floors have been constructed for experimental work. The botanical department has undertaken an investigation of so-called clover-sickness in the State. A number of fungus diseases have been found, and what appears to be the chief cause of the trouble is assigned to a new anthracnose, caused by an apparently undescribed species of Colletotrichum.

Texas College.—H. H. Harrington, for many years professor of chemistry in the college and chemist to the station, has been elected to succeed D. H. Houston as president of the college. Dr. Houston has, as previously noted, gone to the State University as president of that institution.

Utah College and Station.—The shops of the mechanic arts department of the college were almost totally consumed by fire on the night of September 11. The fire was apparently of incendiary origin. The bench rooms, planer and lathe room, forge room, foundry and carriage rooms, with all their contents, were almost complete losses. Some valuable testing machines in the mechanical engineering laboratory were saved. The total loss is estimated at $40,000, with an insurance amounting to $7,100. It is expected that the shops will be speedily rebuilt and reequipped. J. Willard Bolte, of the Michigan Agricultural College, has been appointed poultryman in the station.

The Agricultural Colleges.—The following is taken from *The Breeder's Gazette:* "Practically without exception American agricultural colleges recently opened their fall terms with increased attendance. In some instances the enrollment has been almost doubled. Altogether the increase has been marked, indicating wonderful growth and distribution of interest in agricultural education. It is a good token. Nothing is more significant as showing the trend of the times. It requires but ordinary mental penetration to see the day when the largest success in agriculture as a business will depend upon technical training and commercial sagacity. The colleges ought to be overflowing, every one of them. Their mission is to shape the destiny of agriculture, and hence of the nation, through their students. Their responsibility is tremendous, but they are equal to it. What they have accomplished within a few years, in the face of a disappearing prejudice, is a trustworthy earnest of great service in future."

Manitoba College of Agriculture.—Buildings are being erected for a new college of agriculture for Manitoba, established by a recent session of the provincial legislature, which appropriated $200,000 for the purpose. The college is located at Winnipeg, and its principal is W. J. Black, a graduate of the Ontario Agricultural College, who will have charge of the work in animal husbandry. The principal buildings consist of a main building, 131 ft. long by 67 ft. wide, and 3 stories in height above a high basement; and a science and dairy building, 64 by 66 ft., and 2 stories in height above a high basement.

The main building is of stone and white brick, and the science and dairy building of brick with a stone foundation. The main building, in addition to providing laboratories, class rooms, a library, and an auditorium with a seating capacity of upward of 500, will afford temporary accommodations for about 60 students, the intention being to erect a dormitory building when the increase in attendance warrants. The basement and first floor of the science and dairy building will be used for butter and cheese making, milk testing, home dairying, etc., and the upper floor for laboratory and class room purposes.

In addition to these two buildings, a power house, principal's residence, live-stock auditorium, and horse and cattle barns are being provided. The horse and cattle barns are of modern design, and the live-stock auditorium, which connects them, will afford seating capacity for about 300. The college farm consists of 117 acres, and is immediately outside the city limits of Winnipeg, on the Assiniboine River. The college buildings are located on the banks of this stream, about 4 miles from the center of the city. A part of the farm will be used for experimental work in agriculture, horticulture, and forestry.

The regular college course will extend over two years, and will open immediately after the fall work on Manitoba farms has been completed, and close in time to allow students to reach home before the spring work begins. There will be no rigid entrance examinations, the main requirement being sufficient knowledge of the English language to benefit by the lectures, and practical experience upon a farm covering at least two summers. A tuition fee of $10 per annum will be charged, and board will be furnished at actual cost. There will be special dairy courses in butter and cheese making, to cover from 10 to 14 weeks. "The college in its teaching will be practical in the highest possible degree. It will train practical farmers, not educate them along lines calculated to lead young men from the farm."

It was expected to open the college to students in the regular course in January, but owing to the delay in building, this has been abandoned. It is planned, however, to carry on the dairy school and to offer short courses in animal husbandry and agronomy. W. J. Carson has been elected professor of dairying.

Agricultural High School in Kansas.—A four-year agricultural course is offered this fall in the Norton County High School, at Norton, Kans. The course of study will follow closely the outline suggested by the committee on methods of teaching agriculture in its ninth report (Circ. 60 of this Office), and it is planned to lay especial emphasis upon farm crops, animal production, and farm machinery, all of which are items of great importance in farm practice in Norton County.

Arrangements have been made with the three implement dealers of Norton to assist the teacher of agriculture in giving courses in farm machinery, by taking the agricultural classes into their warehouses under the direction of an expert, who will instruct them in the structure, manipulation, and care of the different machines. It is planned also to take the classes on numerous trips to leading farms in the vicinity of the school to study farm management, domestic animals, and types of farm buildings.

The course is in charge of A. F. Turner, a graduate of the Kansas Agricultural College. It starts out with an enrollment of 9 boys out of a total of 70, and Mr. Turner writes that most of the first-year boys will take up agriculture when they get to it in the course. Arrangements are being made for a grain-judging contest to be held in January, which will be open to all young men in the county. The implement dealers of Norton have offered prizes of farm machinery aggregating in value over $100 for this contest.

A Centralized Agricultural School.—Farragut School, located near Concord, Tenn., is a centralized school comprising within its territory most of the area of three former school districts. It was opened in September, 1904, and its first year was a successful one. The school is supported jointly by the Southern Education Board, which has contributed about $3,500, the State tax levy for the salaries of teachers, and local contributions. The funds thus raised, exclusive of teachers' wages, amount to $8,000, of which $6,000 was expended for a school building and equipment. The building is 54 by 80 ft., 2 stories high, and contains 6 well-lighted schoolrooms and a large assembly room. One of the abandoned schoolhouses has been moved to the site of the new building and is used for domestic science and manual training class rooms.

A small poultry house with incubator and brooder, a two-frame hotbed, and a shed for horses comprise the major portion of the farm equipment. The school has

12½ acres of land, 3 of which are used for horticulture, 6 for farm crops, and the remaining 3½ acres for campus and farmyard. It is the plan to make this a model rural school in which agriculture, domestic science, and manual training shall be leading features. There are at present 5 teachers, including the superintendent and the teacher of agriculture, the latter a graduate of the University of Tennessee. The school is under the control of a local board of 9 members.

Agriculture in New Missouri Normal Schools.—Two new normal schools are to be established in Missouri next year, each to have, among others, an industrial department, in which instruction will be given in agriculture, horticulture, domestic art, domestic science, and manual training and drawing. One-third of the time of each student will be devoted for two years to preparation for teaching industrial subjects in the rural and village schools.

Agriculture in Wisconsin Public Schools.—According to a recent note in the *Journal of Education*, Wisconsin now requires the elements of agriculture to be taught in every rural school in the State, and no diploma can be issued to any pupil graduating from a rural school unless he has had instruction in agriculture.

Agriculture at the College of Science, Poonah, India.—The following facts regarding agricultural instruction in this institution are furnished by Prof. J. B. Knight, a graduate of the Massachusetts Agricultural College and at present professor of agriculture in the college at Poonah. It appears that the College of Science was originally a college of engineering, but in 1879 provision was made for a class in agriculture and forestry and 72 acres of land for a college farm were bought. In 1884 an herbarium and a botanical garden were added, and in 1885 a chemical laboratory.

Two years later a veterinary hospital and operating rooms were provided, and in 1890 graduates from the agricultural class were given a diploma in agriculture. A lecturer in agricultural chemistry was appointed in 1898, and the following year the standard of the agricultural work was raised and the degree changed to licentiate of agriculture. The course given at present covers 3 years and includes theoretical instruction in agriculture, agricultural chemistry, botany, veterinary science, etc. There are at present 77 students taking the agricultural work, by far the larger proportion being first-year men.

Agricultural Instruction in the Transvaal.—According to the last annual report of the Transvaal Department of Agriculture, there is no agricultural school in that country, but the Transvaal Technical Institute has recently been established, and it is expected that this will form the nucleus of a future university, which will include a college of agriculture. In the meantime some instruction in agriculture is provided by making arrangements to receive students or apprentices at the veterinary experiment station and the different government laboratories, experiment farms, fruit gardens, poultry yards, etc. School gardens are maintained in connection with most of the schools in the Marico and North Lichtenburg districts.

Agricultural Schools in the West Indies.—The agricultural schools conducted under the Imperial Department of Agriculture for the West Indies, which are now in operation in St. Lucia, St. Vincent, and Dominica, were established for the special purpose of affording practical training in agriculture to a selected number of boys of about 15 years of age who have passed the fourth standard in the public schools. After passing a probationary period of 3 months, boys are formally admitted into the schools on an agreement being signed by their parents or guardians to allow the boys to remain undisturbed at the school for a period of 3 or 4 years, during which time they not only receive free instruction but are lodged, boarded, and clothed free of expense to their parents.

Winter Schools in the Rhine Province.—There are now 31 winter schools under the control of the Rhine Province Chamber of Agriculture, 4 of which last year completed their twenty-fifth year. At that time the total attendance at the winter schools

had been 11,467 pupils, 3,993 of whom had attended 2 winter terms. A feature of these schools is the variety of special courses, which include horticulture, the utilization of fruit, vine culture, bee culture, feeding, fertilizers, bookkeeping, and domestic economy.

Algerian School of Agriculture.—A school of agriculture with a farm school attached has been organized at Maison-Carrée, which it was expected to open to students on October 9. The number of students is limited to 25, and these will be chosen from candidates 17 years old or older who pass satisfactory examinations in mathematics, chemistry, and natural science.

An Agricultural School in Turkey.—The *Southern Workman* records the organization of the Thessalonica Agricultural and Industrial Institute at Salonica, Turkey, under the control of an undenominational board of 12 directors, incorporated under the laws of the State of New York. The school is on a 52-acre farm, 5 miles from Salonica, and has been in operation about a year and a half. Its work is similar to that of the Hampton and Tuskegee institutes.

Experiment Station Apprentices in Ireland.—The Department of Agriculture and Technical Instruction for Ireland has recently opened three experiment stations located respectively at Clonakilty, County Cork; Ballyhaise, County Cavan, and Athenry, County Galway. In addition to conducting experiments in animal husbandry, dairying, and other branches of agriculture, these stations will admit a limited number of young men as apprentices. These apprentices will be given practical instruction in the work of the farm, shop, and garden, as well as class-room instruction in English, arithmetic, bookkeeping, and technical agriculture in the evenings, and at other times when outdoor work is not pressing. There is a sliding scale of fees ranging from $15 to $16 per session, based on the aggregate valuation of the holdings of the parents of the apprentices.

New Experiment Station in South Australia.—The government of South Australia has set apart 1,000 acres of the Kybybolite Estate, in the southeastern part of the colony, for an experiment station under the control of the Department of Agriculture. The climate at this place is much more humid than at Roseworthy, and a greater variety of crops can therefore be tested. Provision has been made for accepting farm pupils at Kybybolite, who will have an opportunity to take lectures under the professor of agriculture of the Roseworthy Agricultural College.

New Board of Agriculture in India.—The Government of India has recently constituted a board of agriculture, the duties of which are the improvement of agricultural methods by the introduction of better quality of seed grains and roots, by the adoption of up-to-date machinery and implements, by experimenting with soils and fertilizers, and by the study of plant diseases and economic insects. "The board has also under consideration a system of agricultural tuition, with a view to a distribution throughout the country of men trained in the science of the subject." It has been decided to publish a quarterly journal on agricultural subjects, and also to issue separate scientific publications.

New Fertilizer Law in Porto Rico.—The legislative assembly of Porto Rico at its last session passed an act to regulate the registration and inspection of commercial fertilizers, fertilizer materials, and chemicals in Porto Rico, to take effect July 1, 1905. The Commissioner of the Interior is charged with the inspection, and all dealers in fertilizers are required to register their goods with the commissioner, to pay an inspection fee of 25 cents per ton, and to secure from the commissioner tags to be attached to each package setting forth the name of the fertilizer, the name and address of the manufacturer, and guaranteed analysis, including minimum percentages only of available phosphoric acid, nitrogen, and potash. Pulverized leather, raw, steamed, roasted, or in any other form, is barred from use in fertilizers without a full and explicit statement of the fact. Violation of the provisions of the act will be considered a misdemeanor, the penalty on conviction being a fine of not less than

$200 nor more than $500, or imprisonment not to exceed six months in default of payment.

Meeting of Agricultural Implement Manufacturers.—The Twelfth Annual Convention of the National Association of Agricultural Implement and Vehicle Manufacturers, held at Niagara Falls, New York, September 27–29, was a meeting of general interest to American farmers, both because farm machinery is one of the most vital factors in the success of American agriculture and because of the interest which the Association showed at the meeting in methods for the further perfection of its products so as to make them more effectively do the work of the American farm. About 250 members were present. The sessions were well attended, and the reports of the different committees show that the Association, as a whole, is doing much practical work for its members. Among the reports was one from the attorney of the Association, the committees on transportation, legislation, patents, and a lengthy and interesting report on irrigation in arid lands.

On the first day of the session Judge Grosscup, of Chicago, delivered an able address on The Transportation Problem. A representative of the International Harvester Co. also presented a paper on The Necessity for Tax-Free Alcohol for Industrial Purposes.

The literary feature of the second day's session, September 28, was a series of papers by representatives of the Department of Agriculture and the agricultural colleges, the gentlemen submitting papers having been invited by the Association to explain the work done by these agencies to secure the improvement and better use of farm machinery. The first of these addresses was on Practical Farm Mechanics, by Prof. J. W. Gilmore, professor of farm mechanics at Cornell University. This paper dealt with the methods of teaching farm mechanics at Cornell, and explained some of the investigations which that institution is making of farm machinery. Dr. Elwood Mead, Chief of Irrigation and Drainage Investigations of this Office, read a paper on The Applications of Power to Farm Work, showing the importance of a proper adjustment of machines to the power which operates them and the strength of the man that controls them. It also called attention to the evolution now taking place in farm machinery, in which steam, gas, wind, and electricity are displacing both man and animals in operating. Prof. C. J. Zintheo, who has charge of the investigations of farm machinery in this Office, explained some of the studies now being made by the Office, paying especial attention to the work being done to determine the value of denaturized alcohol and of wind as power agents in the operation of farm machinery. Prof. G. N. Knapp, professor of agricultural engineering in the University of Wisconsin, was present and participated in the discussion.

The work of the Agricultural Department and of the various stations which have taken up studies of farm machinery was warmly commended in the discussions of the convention, and the following resolutions were unanimously adopted by the association:

Resolved, That we indorse and commend the agricultural engineering investigations of the United States Department of Agriculture, and believe their extension will benefit both the users and makers of farm machinery.

Resolved, That a committee of three be appointed by the president to confer and advise with the proper governmental authorities about the conduct and extension of these investigations.

We also recommend as a feature of these investigations the establishment of a laboratory and museum for testing and illustration of principles in farm mechanics.

Resolved, That we indorse and commend the teaching of farm mechanics and agricultural engineering in the various agricultural and other colleges, and that we pledge to all of this work our cooperation and support.

Mr. H. E. Miles, of Racine, Wisconsin; Mr. J. Butterworth, of Moline, Illinois; and Mr. Newell Sanders, of Chattanooga, Tennessee, were appointed as a committee

to confer with the U. S. Department of Agriculture on the conduct and extension of investigations of farm implements and machinery.

Suggestions were made by manufacturers that at least half of the men sent abroad to foreign countries by the Bureau of Commerce and Labor, to study the requirements of American commerce, should have a knowledge of farm implements and agricultural practice, as farm implements represent one of the largest lines of American exports. These men should study soils and farm crop conditions, in order that they might report intelligently the character of farm implements which would meet the demands of different localities.

The convention adjourned on the 28th, and on the 29th, at the invitation of Canadian manufacturers, they took a trip to Hamilton, Ontario, where they visited the International Harvester Company's factory, and to Toronto, where a banquet was given in their honor. On the latter occasion addresses on commercial relations and reciprocity were made by prominent men from both the Canadian and American Manufacturers' Associations.

Personal Mention.—Dr. D. E. Salmon, for twenty-one years Chief of the Bureau of Animal Industry of this Department, resigned his position, to take effect October 1.

J. B. Dandeno, assistant professor of botany at the Michigan Agricultural College, and S. F. Edwards, instructor in bacteriology in the same institution, have been appointed to the chairs of botany and bacteriology, respectively, in the Ontario Agricultural College at Guelph.

C. W. Howard, a graduate of Cornell University, and for the past year laboratory assistant in entomology, has been appointed assistant entomologist under the Transvaal Government. The entomologist is C. B. Simpson, also a graduate of Cornell University.

George L. Clothier, formerly of the Forest Service of this Department, has become instructor in forestry in the Mississippi College, a new department having been recently established in that institution. In addition to his instruction in the college, he will carry on propaganda work in forestry in the State, and will conduct some special studies of forest problems in cooperation with the Forest Service.

A press notice states that Don Enrique Fynn, an agricultural engineer of some prominence in South America, has been appointed chief of the division of agriculture in the Argentina Government, which undertakes to provide instruction for farmers and others interested in agriculture, and to generally stimulate efforts for agricultural improvement and development.

Prof. Julius Kühn, of Halle, widely known for his agricultural writings, especially upon feeding animals, celebrated his eightieth birthday October 23.

Dr. H. Fischer has been appointed director of the bacteriological station in the agricultural high school at Berlin.

Prof. W. Hoffmeister, director of the experiment station at Insterburg, Germany, retired October 1. He is succeeded by Dr. W. Zieldorff, chemist of the Hohenheim station.

Miscellaneous.—The late Major Henry E. Alvord bequeathed to the Massachusetts Agricultural College a large collection of agricultural books, pictures, and museum articles. He also left a bequest of "not less than $4,000 nor more than $5,000, preferably the latter," to found a scholarship to be known as the Alvord Dairy Scholarship. The income of this fund is "to be applied to the support of any worthy student at said college, graduate or postgraduate, who may be making a specialty of the study of dairy husbandry (broadly considered) with intentions of becoming an investigator, teacher, or special practitioner in connection with the dairy industry." The bequest is subject to the life interest of Mrs. Alvord.

The Geological Survey of Ireland has recently been transferred from the charge of the board of education to the department of agriculture and technical instruction. In connection with an article on the transference, by Grenville A. J. Cole, describing the survey's work and published in the department's journal, it is mentioned that a laboratory for the examination of soils was established in Belfast in 1837 as a part of the geological survey, and a soil survey projected. "The scheme was unfortunately regarded by the authorities as either immaterial or inopportune, and it was left for Germany, the United States, Japan, and other nations to develop agricultural geology as a branch of organized research." In connection with the accounts of recent drift surveys, chapters on the soils have been included, and now that the geological survey has been transferred to the department of agriculture it is suggested that these drift surveys will be supplemented by the preparation of soil maps for districts of special agricultural interest.

It is learned from *Nature* that the late John Innes, of Merton, Surrey, left his house, the Manor Farm, and two acres of ground, to establish thereon a school of horticulture for giving technical instruction in the science and art of horticulture and the necessary physical and mental training incidental thereto.

It is reported that the Long Island Railroad has located an experimental farm on Long Island, N. Y., to determine the possibilities of bringing the land into productive condition. The land is overgrown with scrub oak and pine, and is typical of large tracts which have never been cultivated, although lying at the very doors of a great market.

The University of Melbourne has received a largely increased endowment from the government of Victoria on condition that a degree course in agriculture be established. It is understood that the necessary arrangements for such a course have been completed.

A monument to the late Max Maercker, director of the agricultural experiment station at Halle, was unveiled in Halle October 24.

The name of the Durham College of Science, Newcastle-upon-Tyne, England, has been changed to Armstrong College. The agricultural department of the college remains in charge of Prof. Douglas A. Gilchrist.

The secretary of state for the British Colonies has appointed Gerald Dodgeon to examine and report upon questions relating to the development of the agricultural resources of British West Africa.

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EXPERIMENT STATION RECORD.

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The statement has recently been made that scientists often retard the progress of general and industrial science by their impractical views of practical affairs. The idea was not that investigation should be confined to utilitarian lines, or that research in pure science should be restricted—for what is pure science in one connection becomes applied science in another, but rather that in various lines of research more rapid and surer progress would be made if investigators brought to their work more practical knowledge of its economic relations. This appears to be a reasonable deduction, and there is much evidence to bear it out. Granting that all knowledge is useful, its useful aspects must be brought out, and there must be intelligence in its application.

In olden times men of science recognized that to secure support for their investigations they must "disguise their work under a utilitarian cloak." As time has gone on the world has become more sympathetic toward science and less exacting in its demands to be assured of its immediate application. This is a result of education and its broadening influence, which has spread by contact to people of all classes; but nevertheless a large body of people continue to distinguish between what to them is theoretical or pure science, and what is applied science. To such, Doctor Jordan's estimate of the value of science that it "lies in its relation to human conduct," and the value of knowledge that it "lies in the use we can make of it," will come as a vindication of a possibly unformulated conviction. As a matter of fact, institutions of research supported by public funds have gained popular support largely because they succeeded in devising helps in economic and utilitarian affairs.

The public expectations of practical results vary somewhat with the character of the investigation and of the institution. In the case of agricultural investigation the expectations have come to run very high, largely as a result of past experience and the confidence which has been inspired in this line of work. The experiment station is an institution for investigation in science as applied to agriculture. It is regarded as a utilitarian institution. Its purpose is the attainment of

results which will have a direct application to one of our fundamental industries—direct in the sense that the gulf which often intervenes between abstract research and its application will be bridged over.

Definite practical knowledge is at a higher premium than ever before. The scientist who is carrying out investigations is more and more expected to develop the economic relations of his work. While we are more and more patient in awaiting conclusions, we expect that a definite ultimate aim will be kept constantly in view, which centers about some phase of agricultural production. This will constitute the real purpose of the undertaking, and will distinguish it in general character from research in pure science.

Furthermore, the final results and suggestions must not only be practical in their relations, but they must be practicable as well. Certain practices which might be suggested are not practicable because they can not be fitted into farm operations, which have to be governed by certain conditions of first importance.

The ability to see clearly the practical bearings of his work and to make its application is not given to every investigator. There are still some evidences of this in our experiment stations, although as a class our station workers possess this ability in probably a greater degree, and are closer in their contact and relations with agricultural practice, than any similar class of workers in the world. The most successful of them have made a study of the farmer's methods and shown a close sympathy with his needs.

We still need in some directions more of intelligent, well-aimed investigation, which will be started right and pursued with a clear purpose to the very end. Our work in some lines is not carefully enough planned. It is fragmentary and not thorough. It needs systematizing, and to have supervision which will stimulate it while giving general direction. This need is enhanced by the division of the men's time between college and station duties, and the interruptions which come from other causes. It is one of the arguments for a director and for a closer organization.

One of the chief criticisms made upon our experiment station work has been the striving to secure practical applications too rapidly, and not giving time enough for the fundamental research on which these applications must rest. It has been asserted that "the proportion of applied science in agriculture is too great in this country," and that "while we do not need fewer workers in applied agricultural science, we do need more workers who would devote themselves to fundamental research"—with an outlook to practical agriculture, doubtless.

No one will dispute the need of more investigation of a fundamental character. The experiment stations themselves have demonstrated this, and their work has led up to it. Before their advent the limita-

tions of our knowledge of agricultural science were not realized, and the gaps which we now perceive were not apparent. As the work has advanced the problems have become more intricate and the call more imperative for systematic and thorough investigation. To realize its importance we have only to remember how the work upon silage preservation was promoted by the discovery of the real nature and cause of the changes, and the influences governing them. Immediately the way was open for more intelligent understanding of the problems. And in cheese making the fundamental investigations which showed the character of the compounds formed, the nature of the changes, and the influence of conditions clarified the whole subject of manufacture and ripening, and simplified the solution of minor problems.

We are approaching the point in a number of departments of the work where there will be much waste of effort and much delay in reaching the final conclusions unless some classic fundamental investigations can be carried out. To enable this will require some relief from the routine of the class room and the laboratory, and from the various forms of extension work. There is a very perceptible movement to free certain of the station experts from heavy teaching duties, which is already affording some measure of relief; but the demands of the farmers' institute upon the station staff show no general diminution.

Last year the station men in forty-three States and Territories took a prominent part in the institute work. This involved three hundred and sixty men, who devoted to it an aggregate of over twenty-six hundred days. In one State alone the station specialists delivered two hundred and twenty-three addresses at institutes and similar farmers' gatherings. This shows a just appreciation of station men as institute workers. They have a message for the farmers, and are in position to give advice upon a wide range of practical questions. This work has increased in dignity and importance, as the great majority of farmers now go to the institutes to be instructed, and these meetings afford opportunity for the oral presentation of the station's work and results. But important as the relation is, it is becoming more and more evident that to a large extent a separate staff of workers will have to be provided for the institutes.

Too much of our work is done under pressure. This applies not only to the experiments themselves, but to the preparation of matter for publication. This seems inevitable under our present system, and where such a mass of material is published some of it is bound to be immature. But the matter might be much improved by more careful editing and supervision.

The lack of editing impairs the usefulness and effectiveness of these writings, especially in the case of stations where little attention is

evidently paid to the matter. In reviewing publications we are not infrequently misled or in doubt as to some important points, owing to the way in which the matter is presented. The data should be carefully computed and compared, and summaries of the more important results given in the clearest manner. A table is a difficult thing for many people to understand, but the difficulties are greatly enhanced if the table is improperly constructed.

There is often a feeling that the publications must be the complete record of the station's work, and hence publications are loaded down unduly with data which adds to the expense of publication and are of interest to only an occasional reader. Ultimately the station's publications should give the permanent record of their work, as far as the important results and application are concerned; but much, if not most, of the data should be retained in the station's unprinted records.

The question may well be asked whether, considering its real purpose, a bulletin should be published for general distribution until it has a definite message to carry. Bulletins which merely record data are of very doubtful value to the general public, and hence their publication in large editions is an unnecessary expense. We still have meteorological bulletins, although not as many as formerly, which give only a record of the weather conditions, with no possible means of comparing them with the crop conditions of the season, and no attempt to trace any relationship. We likewise have soil temperatures reported without reference to anything else, so that they can be of very little value to anyone except the writer, who presumably has other observations related to them. We have descriptions of flora, though fewer than formerly, which stop just short of the vital point to agriculture; and we have weed studies which give the botanical relationships, distribution, and habits of the plant, but only an imperfect method of eradication or subjection, if indeed an attempt is made in that direction.

In the preparation of matter for popular distribution the point of view of the reader should be kept constantly in mind. In a weed bulletin, for example, unless it be merely a preliminary warning, the vital thing to the farmer is a method for eradication, and he has a right to expect when he picks up a bulletin that this has been studied in a thorough manner, and will be presented to him along with the more technical part in a clear, straightforward way. To nearly eradicate a weed is only to reduce its quantity, and the partial remedy will be only temporary. Furthermore, the farmer is encouraged to believe a halfway method will do. If the plant reproduces by rootstocks, the scattering joints, if allowed to remain, will rapidly produce more rootstocks and seeds and the difficulty will continue, often in more serious form.

Instead of being content with a halfway method the author should endeavor to work out and present a thorough method of eradicating

the pest, even though it involve some added labor on the part of the farmer. If the weed is a sufficiently troublesome pest to command attention it is worth serious study, and the attempt should be to prescribe an effective and practicable method of ridding fields of it.

Unfortunately, not all investigators are good writers. They do not have the ability to present what they report in a logical, orderly sequence, so that one can follow clearly step by step and understand without a partial rereading of the article. This lack of coordination is the most serious editorial fault of our station literature, and the inference from it often is the serious one that the writer has not analyzed his subject and coordinated its different parts. The subject is frequently befogged by bringing a side issue into the discussion, and suggestions often lose their force from the manner in which they are presented. Clearness and simplicity of presentation are of far greater importance than form and style, and are especially desirable in publications intended for popular consumption, like the majority of the station bulletins.

There should be some person connected with each station whose business it is to edit the station publications—to read them critically and see that the text and tables are clear and logical. He may not be a special officer, but he should represent the director in this important function. While this work calls for great tact, a discreet and conscientious editor may exert great influence on the character of the literature of a station. This has been demonstrated at several stations where more attention is given to these matters. The investigator should welcome the editor who can suggest some more effective and attractive form for presenting his ideas.

The text should be edited for fact as well as for clearness, and in this the scrutiny of specialists in a number of lines will often be helpful. It will prevent narrowness, and will make the bulletin the product of the constructive and critical skill of a number of minds. It were well for every station man to regard the publication of his bulletin as the culmination of his work upon the subject up to that point, the product by which his colleagues and the world will judge him. His real interest lies in that which will endure, will serve as a basis for science, or will at once serve an economic end. And the people's real interest is that the economic relations of scientific work be so clearly developed that their application can be made in everyday affairs.

The exercises connected with the installation of Dr. Edmund Janes James as president of the University of Illinois occupied most of the week beginning October 15, and were of an unusually interesting character because of the large number of administrative officers and

professors connected with foreign and American universities and colleges who were in attendance, the variety and scope of the papers read, and the subjects discussed at the meetings held during the week.

The wonderful growth of the university in the past ten years, both in material equipment and in the number of its faculty and students, afforded a splendid demonstration of the possibilities of the development of the institutions founded on the Morrill Acts of 1862 and 1890 and the Hatch Act of 1887, when once the people of a State are thoroughly aroused to the importance of maintaining and extending higher education on a National and State basis. This university is directly the outcome of the National land-grant act of Congress for higher education, and has been maintained wholly by State and National funds.

In 1895 the University of Illinois had four colleges in six buildings, less than fifty members on its faculty, and about six hundred students. In 1905 it has eleven colleges in twenty-five buildings, four hundred and eighty-seven members on its faculty, and nearly four thousand students. In the same period the legislative appropriations have increased from $295,000 to $1,500,000.

Among the subjects most prominently and thoroughly discussed on this occasion were the relations of the State to education in both higher and lower schools, and the best methods of administration for American universities. The functions of the university or college president and the relations of the faculty to the president and board of trustees were most earnestly discussed, and a marked divergence of opinion regarding the authority which the president should possess was brought out. It was evident that while university development in this country in recent years has been in the direction of the centralization of authority in the president, there was a strong feeling in the minds of many of the eminent educators gathered on this occasion that this tendency had gone too far, and that in some ways the boards of trustees and the college faculty should be brought closer together and exert more influence in determining the educational policy of the institution.

In the conference of college and university trustees, the first of its kind held in this country, much attention was given to questions relating to the management of finances and accounting for funds. The desirability of stricter accounting and more intelligible and accurate financial reports was strongly insisted on.

Agriculture as a subject on which has been based one of the main divisions of the university, and which in recent years has fully shared in the general prosperity of the institution, was given full recognition in the programme of the installation exercises. In his inaugural address, in which great stress was laid on the importance of maintaining the courses of instruction in the university on a high grade and

increasing research work, President James used the college of agriculture as an illustration of a university department which had developed so rapidly in number of students that it was evident the day was not far distant when it would be impracticable for the university to care for all the students in agriculture who would come for instruction on the present basis. He was therefore in favor of raising the requirements for entrance to the college of agriculture, and at the same time seeking to provide for the secondary education of thousands of students in special public schools to be established in different parts of the State.

The degree of doctor of agriculture was conferred upon former Secretary of Agriculture Norman J. Colman and Hon. A. H. Sanders, editor of *The Breeders' Gazette*, as distinguished leaders of agricultural progress in this country; and at the assembly of the college of agriculture the services of Doctor Colman to agriculture were set forth in addresses by Col. Chas. F. Mills and the Director of this Office. In the response to these addresses made by Doctor Colman, as well as in the remarks of other speakers, the history of the Hatch Act and the consequent development of agricultural education and research in this country were described in outline. In this way attention was drawn to the fact that the National Government, through its Department of Agriculture and Congress, had been largely instrumental in laying the foundations of our present system of agricultural education and research, and had cooperated with the colleges and stations during all the stages of their development.

Last year the trustees of Cornell University passed a resolution creating what is virtually a board of visitors for the college of agriculture, composed of representatives of the State and district agricultural societies. The trustees invited each of these societies to send a delegate annually, at the expense of the university, to visit the college of agriculture and make an inspection of its work.

In accordance with this provision, delegates from a large number of these societies visited the college early in October of this year. An opening talk was given by President Schurman, and Director Bailey spoke to the delegates on the purpose for which the college farm should be utilized. A tour was made of the farms, laboratories, and other buildings of the college and the experiment station, and the work was described. The delegates formed a permanent organization, called the New York State Committee for the Promotion of Agricultural Education and Research, adopted a constitution, and elected officers. The president of the State Breeders' Association was elected president of the new organization, the president of the State Fruit Growers' Association was elected secretary, and the secretary of the Western New York Horticultural Society, treasurer.

The committee will meet at the college in October each year. The authorities look for very good results from this organization. It is

official and representative. It will bring all the farmers of the State into more intimate knowledge and touch with the work of the college and station, and will help to give the various agricultural organizations an individual interest in the institution. It is a recognition of the relation of the college of agriculture to the farmers of the State, and of the fact that the college to be most effective should understand and appreciate the agricultural needs, problems, and aims of that class of people.

Professor Bailey's remarks to the delegates upon the purpose of the college farm are of interest as representing the prevailing views of agricultural educators upon this point and as showing the gradual evolution of ideas which has taken place. The purpose of the farm in connection with collegiate instruction in agriculture has been a fruitful topic of discussion ever since the establishment of agricultural colleges, and the prevalent notion regarding its relation to instruction has undergone many changes.

Professor Bailey presented abstracts of letters bearing upon this point from deans and professors in some of the leading agricultural colleges. The general consensus of opinion was that the college farm should be looked upon as an outdoor laboratory for instruction in those things which require contact with practical things, rather than as a model farm or one for growing maximum crops or for giving students a large amount of practical training.

"It seems to me," Professor Bailey said, "that we have now come to the final and proper stage or idea, that the college or university farm must be a laboratory. The pattern farm, model farm, commercial farm, and illustration farm are all incidental and secondary to this general purpose. . . . A college farm is a means to an end. The end is the teaching of students; the growing of maximum crops may or may not be the best way of attaining this end. We hope to conduct our farms on the best business principles and in conformity with the very best farm practices; we expect to make them interesting and attractive to students and visitors; nevertheless, the laboratory utilization of these areas is to be our first consideration. If we are not using farms as a means of training men, then we are not using them for pedagogical purposes, and the future will not justify our possession of them."

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The determination of phosphoric acid by means of ammonium phosphomolybdate, G. P. Baxter and R. C. Griffin (*Amer. Chem. Jour., 34 (1905), No. 3, pp. 204–217*).—This is a second paper on this subject and deals especially with the nature and amount of the occluded substances in the ammonium phosphomolybdate precipitate.

The results of the investigation confirm the conclusion reached in the previous paper "that it is possible to obtain ammonium phosphomolybdate constant in composition and in a state suitable for weighing, so that it may be used for the accurate estimation of phosphoric acid." The precipitation should be performed at room temperature by pouring the phosphate solution into the molybdic acid. "If the precipitation is performed in the reverse manner the composition of the precipitate varies considerably."

The precipitate is the diammonium salt which when heated to a high temperature with ammonium nitrate is converted almost completely into the triammonium phosphomolybdate. "The ammonium in the precipitate is readily replaced by potassium, in the presence of a high concentration of potassium salts, but the reverse change takes place if the potassium phosphomolybdate is then treated with concentrated ammonium salts." It was found that the precipitate occludes varying amounts of both molybdic acid and ammounium molybdate, according to the conditions of precipitation.

The Pemberton method of determining phosphoric acid by titration of ammonium phosphomolybdate with standard potassium hydroxid is condemned as inaccurate because (1) the precipitate occludes varying amounts of molybdic acid; (2) 24 molecules of alkali are required for the neutralization of 1 molecule of ammonium phosphomolybdate and not 23 as commonly assumed; and (3) titration with phenolphthalein in the presence of ammonia always yields uncertain results.

"No method for estimating phosphoric acid, which depends upon the determination of the molybdic acid in ammonium phosphomolybdate, is accurate unless allowance is made for the occluded ammonium molybdate and molybdic acid."

Determination of citrate-soluble phosphoric acid in superphosphate, O. Seib (*Ztschr. Analyt. Chem., 44 (1905), No. 6–7, pp. 397, 398*).—The following quick method is proposed as a substitute for the official Petermann method used in Belgium:

To 2½ gm. of the superphosphate in a small mortar add in 10 cc. portions while still warm a mixture of 20 cc. of concentrated sulphuric acid and 80 cc. of water, grinding the superphosphate with the acid mixture and pouring off the solution into a ½ liter flask. The operation is repeated 3 times, when the residue is washed into the flask with the remaining acid solution and the flask is shaken for half an hour in a rotary apparatus. The solution is cooled and the flask filled to the mark with water. The solution is filtered and 50 cc. of the filtrate is used for the determination of phosphoric acid by means of magnesia mixture. Comparative tests by the author and others of this method and Petermann's method show closely agreeing results.

On the determination of phosphoric acid, F. RASCHIG (*Ztschr. Angew. Chem., 18* (*1905*), *No. 24, p. 953*).—A reply to Hlavnicka's criticism of the author's method previously noted (E. S. R., 17, p. 6) in which the reliability of the method is maintained and the use of a clear blue glass is recommended to increase the sharpness of the reaction in titrating with methyl orange.

Detection of natural phosphates in phosphatic slags, L. LEDOUX (*Cong. Chim. Pharm. Liège, 1905, pp. 129–134; abs. in Jour. Soc. Chem. Indus., 24* (*1905*), *No. 16, p. 904*).—"The method consists in extracting the phosphate, first with citric acid, which dissolves all the phosphoric acid of the slag, and then with nitric acid. The latter extract only gives a precipitate with ammonium molybdate when mineral phosphates have been added to the slag."

A new reagent for potassium, E. P. ALVAREZ (*Chem. News, 91* (*1905*), *p. 146; abs. in Analyst, 30* (*1905*), *No. 352, pp. 254, 255*).—The reagent proposed is "iconogene," sodium amidonaphthol sulphonate, which it is claimed in 5 per cent solution gives in neutral solutions of potash compounds a white, very brilliant, crystalline precipitate of potassium amidonaphthol sulphonate which is slightly soluble in water and insoluble in alcohol. Ammonia salts are not precipitated and magnesia compounds do not interfere with the reaction, if sufficient ammonium chlorid is present. Nickel, cobalt, and bismuth give precipitates insoluble in excess of the reagent.

Contribution to the analysis of nitrate of soda, R. BENSEMANN (*Ztschr. Angew. Chem., 18* (*1905*), *Nos. 24, p. 939; 31, pp. 1225–1228*).—The method proposed (a preliminary note on which was referred to in E. S. R., 17, p. 7) is as follows:

Dissolve 80 gm. of the nitrate in water, making the volume 1,000 cc., dilute 50 cc. of this solution with water, acidify with nitric acid, and add silver nitrate. The silver chlorid precipitated multiplied by 10.192 gives the per cent of sodium chlorid. Dilute a second portion of 50 cc., acidify with hydrochloric acid, and add barium chlorid. The barium sulphate obtained multiplied by 15.236 gives the per cent of sodium sulphate. Evaporate to dryness 100 cc. of the solution with 16 gm. of crystalized oxalic acid, take up in water, and evaporate to dryness again, repeating this operation 5 times.

Ignite the residue, heating gently at first, and maintaining at a red heat for 15 minutes. Dissolve the ignited mass in water, making the volume 250 cc. Dilute 125 cc. of this solution with water, acidify with nitric acid, and add silver nitrate. The weight of silver chlorid obtained multiplied by 24.146 gives the per cent of potassium perchlorate. Titrate 100 cc. of the solution with standard sulphuric acid (80 gm. of SO_3 per liter), or nitric acid (108 gm. of N_2O_5 per liter), or hydrochloric acid (73 gm. per liter). The acid required, less 0.2735 cc. for each per cent of sodium chlorid and 0.1305 for each per cent of potassium chlorate, multiplied by 3.375 gives the per cent of nitric acid (N_2O_5).

The chlorate is determined by the Gilbert method, as follows: Mix 20 gm. of the nitrate with pyrolusite and some sodium carbonate solution; dry the mixture, melt, and ignite; dissolve the ignited mass in a liter of water; acidify 200 cc. of this solution with nitric acid, and add silver nitrate. The silver chlorid obtained multiplied by 21.359 gives the per cent of potassium chlorate. Tests of the method on a number of samples of nitrate are reported.

The analysis of cyanamid, R. PEROTTI (*Rend. Soc. Chim. Roma, 1904, p. 192; abs. in Ztschr. Angew. Chem., 18* (*1905*), *No. 23, pp. 906, 907*).—In the method proposed cyanamid is dissolved in water, and an excess of ammoniacal silver nitrate is added, the excess being determined by the ordinary potassium sulphocyanate method.

The quantitative estimation of nitric acid and nitrates, W. H. EASTON (*Chem. Engin., 1, pp. 142–145; abs. in Jour. Amer. Chem. Soc., 27* (*1905*), *No. 7, Rev., p. 394*).—An electrolytic method of reducing nitric acid or nitrate to ammonia in a copper solution acidified with sulphuric acid and distilling the ammonia into standard acid is

described. The method of Vortmann based on the use of known amounts of copper sulphate and sulphuric acid and the titration of the excess of sulphuric acid after the reduction of the nitrate is also described.

Determination of nitrites in waters, W. P. MASON (*Jour. Amer. Chem. Soc., 27 (1905), No. 5, p. 614; Chem. News, 91 (1905), No. 2379, p. 299*).—A brief note calling attention to the considerable amounts of nitrites which may get into distilled water in the laboratory from the presence of burning Bunsen lamps.

The rapid analysis of cream of tartar and tartaric acid baking powders, R. O. BROOKS (*Pennsylvania Sta. Rpt. 1904, pp. 141–145*).—This description of a method suggested for the examination of baking powders was presented at the meeting of the Association of Official Agricultural Chemists in 1904 (E. S. R., 16, p. 327).

Analysis of formaldehyde sold in North Dakota, E. F. LADD (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 18–20*).—Analyses of a large number of samples of formaldehyde are reported. The data for the different samples are grouped according to the drug companies from which they were reported by retail druggists as having been purchased.

Forty-one samples showed a maximum, minimum, and average formaldehyde content of 42.41, 36.78, and 39.72 per cent respectively; 34 samples maximum, minimum, and average percentages of 41.40, 34.87, and 38.82; 19 samples maximum, minimum, and average percentages of 39.82, 25.42, and 33.75; 41 samples maximum, minimum, and average percentages of 39.37, 21.60, and 35.12; and 81 samples maximum, minimum, and average percentages of 41.28, 14.17, and 37.40. Experiments made at the station showed that formaldehyde does not lose strength upon standing.

The results indicate that commercial formaldehyde is adulterated to a considerable extent, which is believed to be the main reason why formaldehyde has not given more general satisfaction in the treatment of wheat smut. It is reported that retailers have been found guilty of selling short weight or measure, and it is believed that the price at which formaldehyde has been retailed is out of proportion to its cost.

Detection of adulteration in maple sugar and sirup, C. H. JONES (*Vermont Sta. Rpt. 1904, pp. 446–457*).—This is a preliminary report on studies which are being made at the station on the detection of cane sugar when added to maple products.

The amount and character of the ash is considered of special importance in differentiating pure from adulterated products. On the basis of numerous analyses the minimum ash content of pure maple sirup weighing 11 lbs. to the gallon is placed at 0.5 per cent and of maple sugar at about 0.6 per cent, which minimum figures it is stated are rarely attained even with far more thorough filtration than factory equipment affords. The methods employed and the results obtained in the analysis of the ash of 24 samples of pure and 8 of adulterated maple products, and of 8 commercial samples of brown sugar, raw cane sugar, and glucose are reported. The determinations to which particular importance is attached are the total ash and the amount and alkalinity of the soluble and insoluble ash.

The determination of the volume of the precipitate produced in the sugar solution by lead subacetate, while having its limitations, is considered of great value and capable of practical application. This test as used by the author is made by dissolving 5 gm. of the sample in 10 cc. of water, transferring to a graduated sedimentation tube, adding 2 cc. of standard lead subacetate solution, and centrifuging for 4 minutes at a speed of 1,400 revolutions per minute. Pure maple products of average quality show a reading varying from 1.5 to 3 cc. A similar test has been worked out and used by Hortvet (E. S. R., 16, p. 846).

The author also discusses the reliance that may be placed upon the aroma and color of maple products, and the ratio of lime to potash. The limited number of analyses reported show a much higher ratio of lime to potash in brown sugar than in maple products and also a higher sulphate content. Further investigations are to

be made along these lines, and also concerning the organic acids normally present in pure maple products.

On the determination of fat in milk poor in fat, T. S. THOMSEN (*Landw. Vers. Stat., 62 (1905), No. 4-5, pp. 387-399*).—Experiments were made with buttermilk, skim milk, and various mixtures and dilutions of these with water. The Gottlieb method gave higher and, according to the author, more reliable results than the extraction method. The results of fat determinations on buttermilk and skim milk before and after peptonizing led to the conclusion that the impurities in the fat obtained by the Gottlieb method are very slight.

A study of the Hübl, Hanus, and Wijs methods of iodin absorption, H. L. WILSON (*Pennsylvania Sta. Rpt. 1904, pp. 146-150*).—The work here reported was done in cooperation with the associate referee on fats and oils of the Association of Official Agricultural Chemists, the results of which have already been noted in the report of the referee (E. S. R., 15, p. 438).

Some notes concerning Halphen's test for cotton-seed oil, E. FULMER (*Washington Sta. Bul. 67, pp. 3-10*).—Noted from another publication (E. S. R., 14, p. 836).

Reaction of lard from cotton-seed meal fed hogs with Halphen's reagent, E. FULMER (*Washington Sta. Bul. 67, pp. 11-27*).—Noted from another publication (E. S. R., 16, p. 226).

The precipitation limits with ammonium sulphate of some vegetable proteins, II, T. B. OSBORNE and I. F. HARRIS (*Amer. Jour. Physiol., 13 (1905), No. 5, pp. 436-447*).—The present paper is a continuation of work previously noted (E. S. R., 15, p. 222). The principal conclusions drawn from the investigations are as follows:

"Hofmeister's method of fractional precipitation of proteins from their solutions by ammonium sulphate affords, in most cases, a valuable and ready means for the separation of such substances when associated in the same solution.

"The precipitation limits are not characteristic for each individual protein substance, as is commonly assumed, but appear to depend on the conditions existing in the solution at the time of precipitation. . . .

"Vegetable globulins can not be distinguished from vegetable albumins by means of their precipitation limits with ammonium sulphate, since many of these globulins are not precipitated until the concentration in ammonium sulphate is raised well above one-half saturation, while leucosin, the best characterized albumin of vegetable origin now known, is almost completely precipitated at one-half saturation."

The glycocoll content of different proteids, F. DUBROWIN (*Inaug. Diss., St. Petersburg, 1902; abs. in Physiol. Russe, 3 (1904), Nos. 48-60, p. 184*).—Cleavage was induced in a large number of proteids by treatment with sulphuric acid. No glycocoll group was found in the vegetable proteids examined. On the other hand, the proteids of connective and skeletal tissue gave large quantities of glycocoll. Judged by the glycocoll content of their cleavage products collagen, ossein, chondin, and elastin are closely related. The proteid of the crystalline lens of the eye was found to contain 4.5 per cent tyrosin and 0.7 per cent glycocoll. No glycocoll was found in the cleavage products of myosin.

Determination of hippuric acid in urine, R. E. STALLINGS (*Pennsylvania Sta. Rpt. 1904, pp. 151-154*).—Using a modification of König's method, hippuric acid, uric acid, and benzoic acid were determined in samples of urine of a steer, and also to test the method in an artificial mixture of these acids to which a small amount of sodium hydroxid had been added. In the case of the artificial mixture, the results obtained for hippuric and uric acids were too low. The greatest discrepancy was observed with the uric acid, while the benzoic acid was too high. In the case of urine, fairly concordant results were obtained.

Ten lectures on biochemistry of muscle and nerve, W. D. HALLIBURTON (*Philadelphia: P. Blakiston's Son & Co., 1904, pp. XVI+160, pls. 8, figs. 17; rev. in Jour. Amer. Chem. Soc., 27 (1905), No. 4, pp. 448–450*).—The topics considered have to do with muscle ferments, pigments, glycogen, lactic acid, creatinic, and phosphocarnic acid, the chemical changes accompanying contraction, muscle proteids, the metabolism of nerve, coagulation of nerve proteids, the chemical changes in nerve during degeneration and regeneration, and related topics. The volume embodies the author's opinions based on the results of his investigations.

Miscellaneous analyses, C. H. JONES and F. M. HOLLISTER (*Vermont Sta. Rpt. 1904, pp. 457–461*).—Analyses are reported of 20 samples of materials furnishing nitrogen, phosphoric acid, and potash, 15 samples of wood ashes, 2 samples of home-mixed fertilizers, 2 samples of Peruvian guano, 4 samples of muck, and 1 sample each of barley and weed silage, oats and pea silage, foul seed, bone and lime, dry waste and greasy waste from a woolen mill, hen manure, weed killer, and maple sugar.

Report of the chemist: Division of foods and feeding, J. B. LINDSEY (*Massachusetts Sta. Rpt. 1904, pp. 37–44*).—In this part of the report statements are made concerning the extent and character of the work done during the year. Of 2,026 pieces of glassware examined in the execution of the dairy law, 200 were found inaccurately graduated.

Report on general work in the chemical laboratory, C. A. GOESSMANN (*Massachusetts Sta. Rpt. 1904, pp. 104–110*).—Brief notes on the examination of wood ashes, lime ashes, and miscellaneous material, and on phosphatic slag and experiments with native phosphates.

By fusing 1 part of Canadian apatite, containing 31.22 per cent of phosphoric acid, with 4 parts of a mixture of 23 parts of sodium carbonate and 39 parts of potassium carbonate, 3.68 per cent of the phosphoric acid was made soluble in water and 26.78 per cent soluble in neutral ammonium citrate, leaving only 0.76 per cent insoluble. By fusing 1 part of the apatite with only 1.15 parts of the carbonate mixture (the theoretical amount required to convert the phosphate into soluble form), 2.56 per cent of the phosphoric acid was made soluble in water and 15.96 per cent soluble in citrate solution. Boiling the phosphate in solutions of the carbonates of various strengths showed little effect in rendering the phosphoric acid soluble.

Proceedings of the twenty-first annual convention of the Association of Official Agricultural Chemists, held at St. Louis, Mo., September 26, 27, and 28, 1904, edited by H. W. WILEY (*U. S. Dept. Agr., Bur. Chem. Bul. 90, pp. 254*).—This is the official report of the proceedings of the convention. A summarized account of the meeting has been given (E. S. R., 16, p. 320), and a circular of the Bureau containing extracts from the proceedings noted (E. S. R., 16, p. 539).

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 33 (1905), Nos. 4, pp. 127–182, figs. 6, charts 13; 5, pp. 183–232, figs. 16, charts 10*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of April and May, 1905, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 4.—Special contributions on Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—III, The Diurnal Periods of the Vapor Tension, the Electric Potential, and Coefficient of Dissipation, by F. H. Bigelow; The Observations with Kites at the Blue Hill Observatory, 1897–1902, by F. H. Bigelow; Mathematical Theory of the Nocturnal Cooling of the Atmosphere (illus.), by S. T. Tamura; The

Influence of Small Lakes on Local Temperature Conditions (illus.), see p. 224, by J. L. Bartlett; The Great Indian Earthquake of April 4, 1905, as Recorded at the Weather Bureau (illus.), by C. F. Marvin; Rhododendron Leaves as Thermometers, by J. F. Johnson; Fake Rainmaking, by W. L. Moore; Wind Velocities for Different Altitudes and Exposures, by A. J. Mitchell; Tornadoes of March 17, 1905, in Western Oklahoma, by C. M. Strong; Some Temperatures Taken on Lakes Huron and Superior in July and August of 1904, by F. L. Odenbach; A Cold Weather Dust Whirl, by F. W. Proctor; Note on the Winds of the Region Adjacent to the Gulf of California, by G. H. Stone; A Heavy Deposit of Hoarfrost and its Effect in Retarding Nocturnal Cooling (illus.), by D. A. Seeley; and Tornado of April 14 near Pensacola, Fla., by W. F. Reed, jr.; and notes on unusual weather at Dodge, Kans., snow and frost crystals, tidal phenomena, and meteorological course at Williams College.

No. 5.—Special contributions on Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—IV, The Diurnal Periods of the Terrestrial Magnetic Field and the Aperiodic Disturbances (illus.), by F. H. Bigelow; Proposed Observations in Meteorology to be Undertaken during the Expedition to Observe the Total Eclipse of the Sun in Spain and Tunis. August 30, 1905 (illus.), by F. H. Bigelow; Snowfalls, Freshets, and the Winter Flow of Streams in the State of New York (illus.), by R. E. Horton; The Rainfall of the Drainage Area of New Orleans, La. (illus.), by F. S. Shields; Canadian Seismographic Records (illus.), by R. F. Stupart; and Supplying Moisture in Connection with Artifical Heating, by G. A. Loveland; and notes on meteorology and the teachers of physics, sounding balloons at St. Louis, Mo., atmospheric explorations in the Tropics, atmospheric electricity, notes on earthquakes by Weather Bureau observers, and storm warnings at wireless telegraph stations.

Summaries of temperatures, rainfalls, and sunshines, E. F. LADD (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 12–17*).—Tables are given which show the monthly and annual temperature and rainfall for 1904, the annual rainfall since 1892, monthly and annual rainfall since 1895, monthly and annual sunshine record for 1904 and for each year since 1899, and daily observations on evaporation from a water surface, May to September, 1904, with monthly summaries of evaporation and rainfall for the same period during the years 1902 and 1903.

The mean temperature as recorded at Fargo for the year 1904 was 37.05° F.; the maximum temperature 91, in August; the minimum —39, in January. The annual rainfall was 20.26 in. as compared with 20.83 in. for the previous 13 years. The averages for a series of years show that the larger proportion of the rainfall occurs during the growing period, the total rainfall or snow calculated as rain for the 5 months, November to April, being less than 2 in.

"There has been since 1901 a regular decrease in the per cent of sunshine recorded from 49.43 per cent to 39.04 per cent. There has been also an increase in cloudy weather but a decrease in evaporation from a water surface and generally an increase in rainfall."

The total amount of water evaporated from a water surface during May to September, 1904, was 6.09 in. per month or 0.215 in. per day, the total amount evaporated during the period being 30.44 in. as compared with 28.12 in. in 1902 and 41.87 in. in 1903. "In 1902 the evaporation was 1.96 times the rainfall for the same period. In 1903 it was 2.58 times as great, and in 1904 it was 2.47 times as great. Or, in other words, the evaporation from a water surface is from 2 to 2.5 times the amount of the rainfall for the months under consideration."

Meteorology, T. M. CARPENTER (*Pennsylvania Sta. Rpt. 1904, pp. 155–169, 269–291*).—The observations here recorded are of the same character as those reported in previous years (E. S. R., 16, p 750). Monthly summaries of observations are given in the body of the report and the detailed record in an appendix. The summary for 1903 is as follows:

Summary of meteorological observations, 1903.

	1903.	Growing season (Apr.-Sept.).
Barometer (inches): [a]		
Mean	30.051	
Highest	30.758 (Nov. 21)	
Lowest	29.237 (Apr. 3)	
Temperature (° F.):		
Mean	48.4	61.4.
Highest	89 (July 3, 10)	89 (July 3, 10).
Lowest	−6 (Feb. 19)	18 (Apr. 5).
Mean daily range	17.5	19.2.
Greatest daily range	45 (Apr. 4)	45 (Apr. 4).
Least daily range	3 (Mar. 7, Aug. 28, Oct. 5, Dec. 9).	
Mean daily relative humidity (per cent)	79.6	79.2.
Rainfall (inches):		
Total	44.09	25.73
Greatest monthly	7.25 (June)	
Greatest daily	3.12 (Aug. 28)	3.12 (Aug. 28).
Number of days on which 0.01 in. or more of rain fell.	131	69.
Mean percentage of cloudiness	56.5 [b]	57.4.
Number of days on which cloudiness averaged 80 per cent or more.	114	57.
Average hours of sunshine per day		6 h. 18 m.
Last frost in spring		May 9
First frost in fall		Sept. 19.

[a] January and February not included. [b] January not included.

Weather of 1904, S. Blore (*Year Book Col. Agr. and Hort. Holmes Chapel, 1904, pp. 23–28, charts 2*).—Weekly averages of barometer readings, temperature, and precipitation at the College of Agriculture and Horticulture, Holmes Chapel, Cheshire, England, are recorded in tables and diagrams, and the general weather conditions of the year are discussed.

"The total rainfall for the year, 24.03 in., is the lowest since 1887, when 20.42 in. was registered. July and August were the wettest months with 2.83 and 3.73 in., respectively. March and June were the driest with 1.17 and 0.94 in. There were only 174 days on which a recordable amount of rain fell as compared with last year's 204. . . . The chart of the weekly barometric reading . . . shows clearly the steadiness of the barometer during the periods when little or no rain fell and also the great fluctuations from drought to rain and vice versa. . . . The chart of weekly average temperatures, maximum and minimum, shows a gradual rise from the beginning of the year to the middle of July, and then a similar fall to the end of the year, with some few variations. The highest temperature of 85° F. was reached on August 3, and the lowest was 22 degrees of frost registered during . . . November."

Climatological data for the year 1904 (*Rpt. Bur. Agr., Labor and Indus. Mont., 9 (1904), pp. 388, 389*).—A compilation of observations at 45 places in the State on temperature, precipitation, cloudiness, and direction of wind, with data for elevation and the number of years records have been kept.

Results of meteorological observations in the year 1902 (*Ber. Met. Com. Naturf. Ver. Brünn, 22 (1902), pp. XIV+170, charts 6*).—This is the twelfth report of the meteorological commission of the Society of Naturalists of Brünn, Austria, giving detailed tabular summaries of observations at a large number of stations under the direction of the central office of Brünn.

Meteorology, P. Bonâme (*Rap. An. Sta. Agron. Mauritius, 1904, pp. 1–9*).—A record is given of observations during 1904 at the agricultural experiment station of Mauritius on atmospheric pressure, temperature, precipitation, humidity, and evaporation.

The weather 1904–5, F. J. Plymen (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 262, 263*).—The general weather conditions at the Southeastern Agricultural College at Wye during the 17 months ended May 31, 1905, are described.

Notes on the difference of temperature, McGill College grounds and Mount Royal, Montreal, Canada, C. H. McLeod and H. T. Barnes (*Proc. and Trans. Roy. Soc. Canada, 2. ser. 10 (1904), Sec. III, pp. 71-125, pls. 25*).—Comparative observations on the college grounds, 180 ft. above sea level, and on Mount Royal, 800 ft. above sea level, are reported in tables and diagrams and briefly discussed.

The curves show "that any marked change in temperature at the lower station has been heralded by a change in the same direction at the higher station by an interval of time, sometimes as great as 24 hours. This interval, which seems to be very variable, depends probably upon wind conditions. . . .

"No attempt has been made to trace the connection between wind or general weather conditions and the differential curves. Without consideration of such effects it would appear that the following relations hold: (*a*) Normal differences in temperature vary with the average air temperature, increasing negatively as temperature falls. (*b*) Departure from normal differences in a negative direction indicates lower air temperatures, and in a positive direction change to warm weather."

Reprints of papers and charts relating to meteorology and terrestrial magnetism, G. Hellmann (*Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus. Berlin: A. Asher & Co., 1904, vol. 15, pp. 328; rev. in Science, n. ser., 22 (1905), No. 552, p. 116*).—This is the fifteenth and final volume of this bibliographical work, including the more important papers relating to meteorology and terrestrial magnetism.

The influence of small lakes on local temperature conditions, J. L. Bartlett (*Mo. Weather Rev., 33 (1905), No. 4, pp. 147, 148, fig. 1*).—A comparison is made of observations on temperature at Washburn Observatory, University of Wisconsin, which is located on a ridge between Lakes Mendota and Monona, and at Harvey, Portage, Beloit, and Dodgeville, located respectively to the east, north, south, and west of Madison, within a radius of 45 miles from that city.

The results, which are shown diagrammatically, make it clear that the lakes have a considerable influence on the temperature conditions. This influence is exerted in preventing the occurrence of killing frosts in the late spring and early fall. The range of temperature at Madison during January and February, when the lakes are almost invariably thickly coated with ice, averages over 2 degrees less than at the other points. During August the minimum curve reaches its extreme positive departure and the daily range of temperature averages 6 degrees less than that of neighboring purely continental exposures.

"While the exposure at Madison especially favors the influence of the lakes on the observed temperatures, yet it is believed that wherever small lakes are found the temperature conditions in their vicinity will show departures from the purely continental type of their section much resembling those given above, though not so marked."

The sun and nature, C. Flammarion (*Separate from Bul. Soc. Astron. France, 1905, July, pp. 10, figs. 3*).—A report on observations at the Paris observatory on the relation between variations in sun spots and the leafing and flowering of trees.

The farmer and the weather map, H. H. Lyon (*Country Gent., 70 (1905), No. 2745, pp. 809, 810*).—This article advises farmers to study the daily weather map more closely, especially the position and movement of the high and low areas. It suggests that "it would be a great help to the farmer and would tend to popularize the Weather Bureau" if, in addition to the daily forecasts published in the daily papers, the forecast official would state in simple language "the position of the 'low' areas, indicate their probable or possible course, and the rapidity of their movement. He could state the chances of their containing large or small quantities of moisture and something regarding their probable time and manner of exit from any given area."

Weather forecasts in the service of agriculture, GROHMANN (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 29, pp. 225–227, fig. 1*).—The postal-card method of distributing forecasts practiced by the Royal Saxon Meteorological Institute is described and commended.

Fake weather forecasts, F. J. WALZ (*Pop. Sci. Mo., 67 (1905), No. 6, pp. 503–513*).—A review of various popular and fallacious methods of weather forecasting.

On the significance of Bacillus coli in potable waters, H. VINCENT (*Ann. Inst. Pasteur, 19 (1905), No. 4, pp. 233–248*).—The author refutes Löffler's contention that it is not possible to judge of the value of a water by the number of micro-organisms present and that special methods for determining simply *Bacillus coli* or the bacilli of putrefaction are not necessary. He maintains, on the contrary, that bacteriological analysis is of great value in determining the quality of water.

The delicate methods which have been devised for the numerical determination of *B. coli*, the organisms of putrefaction, or pathogenic germs, particularly the typhoid bacillus, have been of great importance in determining the efficiency of methods of purification of waters, in improving sanitary conditions of cities, and in preventing or arresting epidemics, especially those of typhoid fever.

SOILS—FERTILIZERS.

The principal soil areas of Iowa, W. H. STEVENSON, G. I. CHRISTIE, and O. W. WILLCOX (*Iowa Sta. Bul. 82, pp. 373–394, figs. 3, map 1*).—This bulletin gives the results of investigations of the principal soil areas of Iowa, based upon the work of the Iowa Geological Survey on the glacial geology of the State.

It is stated that "all the soils of Iowa without exception are, in respect to their origin, referable to one or the other of four easily distinguishable classes, which are to be found in plainly marked areas." These classes, which are mapped and fully described in the bulletin, include (1) geest, or soils resulting from the secular decay of indurated rocks; (2) soils of fluviatile origin, or stream-made soils (alluvium); (3) soils of æolian origin, or wind-made soils (loess); and (4) soils of glacial origin, or ice-made soils (drift or till); or, more briefly, geest, alluvium, loess, and till.

The loess and till are the most important of these classes. "Geest occurs chiefly in Winneshiek, Allamakee, Fayette, Clayton, Delaware, Dubuque, and Jackson counties, and only very rarely and in trivial amounts in other parts of the State." Alluvial soils or "bottom lands" "occur all along the courses of every important stream in Iowa. The Missouri, Big Sioux, Nishnabotna, Nodaway, Grand, Chariton, Des Moines, Skunk, Iowa, Cedar, Wapsipinicon, and Mississippi rivers and their tributaries have bottoms of varying widths." They occupy not over 6 per cent of the total area of the State and when properly drained are generally highly productive.

Practically all of the remaining area of the State is occupied by loess and drift (till) soils. "There are three distinct areas of loess soils, the Missouri loess in western Iowa, the Mississippi loess in eastern Iowa, and the loess of southern Iowa." The loess soils as found in Iowa are generally light colored (various shades of buff and yellow, sometimes becoming whitish), fine-grained, but porous and as a rule fertile.

"There are three distinct areas of glacial till, the Wisconsin, the Iowan, and the Kansan. In their relations to agriculture these are typically characteristic of the age of the till." The drift (till) soils differ somewhat with their age. The Wisconsin drift "is principally a black loam, sandy in some places and clayey in others. It is generally rich in the elements of plant food and frequently contains small bowlders of various materials, including granite. . . . The soils of the Iowan drift sheet do not differ very much from those of the Wisconsin; peat bogs and alkali are very much rarer." The Kansas drift occurs in only limited areas on hillsides and

slopes in western and southern Iowa and is uniformly unproductive. In the older drift areas the soils have undergone more complete weathering and leaching than in the more recent areas, and consequently are as a rule lighter in color, poorer in soluble constituents, and contain less undecomposed rock.

The geological origin and general properties of the different classes of soils are discussed and some of the problems which need investigation in connection with each are pointed out.

Soils, H. INGLE (*Transvaal Agr. Jour., 3 (1905), No. 12, p. 731*).—Averages of 11 samples of virgin soils collected along the banks of the Vaal River are reported, which show nitrogen 0.075 per cent, lime 0.94, phosphoric acid 0.045, and potash 0.27. The average of 10 samples collected in the White River Settlement, Transvaal, shows nitrogen 0.093, lime 0.048, phosphoric acid 0.051, and potash 0.20 per cent.

Some soil analyses, A. PARDY (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 6, pp. 573, 574*).—Analyses with reference to total and available constituents, water capacity, etc., of 3 samples of soils from different parts of Natal are reported.

These analyses show that, "compared with the rich fertile soils of other countries, these are poorly supplied all round with the ingredients desirable in a highly productive soil. They are deficient in organic matter and are liable to be quickly affected by atmospheric influences—temperature, rain, and drought. The soils are only capable of holding a limited supply of moisture." The use of lime, barnyard manure, and green manures to improve the fertility of the soils is suggested.

Results obtained in examination of thin layers of soil, A. DELAGE and H. LAGATU (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 23, pp. 1555–1558*).—A reply to criticisms of previous notes on this subject (E. S. R., 16, p. 756), explaining the practical application of the method as a supplement to mechanical and chemical analyses and in helping to explain the varying assimilability of the potash and phosphoric acid in different soils.

Classification and nomenclature of soils according to mineralogical constitution, H. LAGATU (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 6, pp. 363–366, fig. 1*).—Applying the method of mineralogical examination (referred to in the last article), the author describes more in detail a graphic method of interpreting the results and classifying soils on the basis of their content of lime, clay, and sand.

Soil temperatures, S. BLORE (*Year Book Col. Agr. and Hort. Holmes Chapel, 1904, p. 29, chart 1*).—Weekly averages of soil temperature at the surface and at depths of 3, 6, 9, and 18 in. and 3 and 6 ft. at the College of Agriculture and Horticulture, Holmes Chapel, Cheshire, are recorded. Observations on soil temperature are a new feature of the work of the college observatory. It is proposed to trace the relation of soil temperature at varying depths with that of the air above, as well as its bearing upon plant growth.

The percolation of rain water through soils, W. F. SUTHERST (*Chem. News, 92 (1905), No. 2384, p. 49*).—The author records the results of observations on the rate of percolation of water through sandy loam, loam, clay loam, heavy clay soil, and garden soil which had been subjected to prolonged drought. For the purpose of the observations the soils were packed in glass tubes 1$\frac{3}{8}$ in. in diameter and water was poured on them from time to time in amounts equivalent to 0.1 to 1 in. The slowness of percolation in case of the clay soils indicates that with such soils more than 50 per cent of the rainfall (the proportion given by Lawes and Gilbert) would be lost by evaporation and surface drainage.

The alkali soils of Montana, F. W. TRAPHAGEN (*Montana Sta. Bul. 54, pp. 91–121, pls. 5*).—This bulletin gives a summary of investigations on alkali soils in Montana and elsewhere, largely from a previous bulletin of the station (E. S. R., 11, p. 223), and reports results of pot experiments with alfalfa, oats, wheat, barley, and timothy on soils containing varying amounts and combinations of alkali salts. Analyses with reference to chlorin, sodium sulphate, and sodium carbonate of 358 samples of

alkali soils from different parts of the State are reported. No data are reported for the experiments, but the following summary of general results is given:

"The presence of magnesium sulphate—Epsom salt—in quantity up to 1 per cent has apparently no ill effect upon the growth of alfalfa.

"The limiting quantity of sodium sulphate—Glauber's salt—for alfalfa seems to be about seven-tenths of 1 per cent.

"With a mixture of two-thirds sodium sulphate and one-third magnesium sulphate, which represents very closely the composition of Montana alkali, the limiting quantity appears to be about the same as with sodium sulphate alone.

"It should be said that these experiments were conducted with great care, the purpose being to eliminate every adverse condition except that imposed by the presence of the 'alkali.' Especially was it provided that a sufficient quantity of water should always be present.

"In this connection it may be stated that the presence of alkali was observed, in another series of experiments, to very materially increase the drought-resistant powers of the plants under investigation.

"The results of experiments with oats, wheat, barley, and timothy tend to show that the danger limit for alkali of the character of that found in Montana is above 1 per cent."

The nature and treatment of alkali spots, L. E. KELSEY (*Iowa Agr.*, *6* (*1905*), *No. 1, pp. 12, 13*).—The small alkali areas occurring in the Wisconsin glacial drift soils of the west-central part of northern Iowa are described, as well as the various methods of reclamation which have been proposed for such soils. Underdrainage with liberal applications of coarse manure is considered the most effective and practical means of reclamation yet proposed.

Ant heaps, H. INGLE (*Transvaal Agr. Jour.*, *3* (*1905*), *No. 12, pp. 729–731*).—Analyses of ant heaps and of surrounding soil are reported which "indicate much greater fertility in the ant heap material than in the soil on which it occurs. The organic matter and nitrogen are particularly noticeable, the latter being more than four times as abundant in the ant heap, while the 'available' potash and phosphoric acid are also much higher." These analyses, as well as the experience of a number of practical farmers which is recorded, indicate that "pulverized ant heaps might with advantage be used as a manure on poor soils, and should be of great value in gardens, for seed beds, etc., provided that their physical properties—fine texture, etc.—do not render them too close and impervious."

On the accumulation of fertility by land allowed to run wild, A. D. HALL (*Jour. Agr. Sci.*, *1* (*1905*), *No. 2, pp. 241–249*).—The article records observations on 2 plats of land, one of which was originally in wheat, the other in leguminous plants (beans and clover), which have been allowed to run wild, the first since 1882, the second since 1885.

Examination of the soils at the beginning of the experiment and in 1904 shows a marked increase of carbon and nitrogen in the surface, the rate of increase of nitrogen in the wheat soil being 100 lbs. per acre annually, in the other soil 25 lbs. The mechanical composition of the 2 soils is shown to be very similar, and it is thought that their difference in behavior under cultivation and in natural vegetation (that of the one being nearly free from leguminous plants, that of the other containing considerable of such plants) may perhaps be due to absence of calcium carbonate in the former, while the latter is well supplied with this substance as a consequence of liberal application of chalk in former period (the eighteenth century).

Manurial requirements of the Leonardtown loam soil of St. Mary County, Md., F. D. GARDNER (*U. S. Dept. Agr., Bur. Soils Circ. 15, pp. 13*).—Tests by the "wire-basket" method of the manurial requirements of "good" and "poor" samples of this soil, which is a light-colored silt loam of varying fertility, are reported. The soils were treated with organic manures (barnyard manures of various kinds, organic

matter from city dump, and green manures), lime, and chemical fertilizers (sodium nitrate, potassium sulphate, and tricalcium phosphate). Wheat plants were grown on the soils by the wire-basket method as follows:

"Five small wire baskets 3 in. in diameter by 3½ in. in depth are used for each treatment. After the soil has been treated with its respective fertilizer and brought up to the optimum water content with distilled water, the equivalent of about 325 gm. of dry soil is placed in each basket. The soil is firmly packed, and 6 germinated kernels of wheat are planted in each basket. During the process of packing a small portion of the soil presses out through the wire mesh, but this is brushed off and returned to the interior of the basket, after which the basket is at once dipped into melted paraffin, which not only forms an intimate contact with the soil, but also produces a water-tight covering.

"An eighth to a quarter of an inch of washed quartz sand is now placed over the soil of each basket, and its contents at once weighed and the weight recorded. In from 3 to 5 days the wheat plants will have emerged from the soil and have a height of approximately 1 in., at which time the surface of the basket is sealed—that is, it is covered with a piece of paper having a small opening in the center sufficiently large to permit the plants to pass through. The paper is dipped in melted paraffin just before placing it over the soil, and then a small amount of paraffin is run around the outer edge of the paper, thus forming contact with the side of the basket.

"In this way all evaporation from the soil is prevented, excepting the minute amount which may pass through the small opening immediately around the plants. The loss from this source is so slight in comparison to that which is transpired by the plants that no account is taken of it, but even if the loss were considerable it should be practically the same from all baskets. The weight of the basket is taken immediately before sealing and immediately afterwards, in order to ascertain the weight which has been added to it in the process of sealing. This increase is now added to the original weight of the basket, and the result is what is known as the 'optimum weight,' or that weight at which the contents of the basket contain the most favorable amount of moisture for the growth of plants.

"During the growing of the plants, which usually continues from 18 to 21 days from the date of sealing, the baskets are weighed at intervals of 2 or 3 days and watered with distilled water, in order to retain a favorable moisture content for plant growth. By this method the loss of water or the amount transpired by the plants is ascertained periodically, and at the end of the experiment the total amount of water given off through the plants of each basket is obtained for comparison with the growth and green weight of the plants, which is ascertained by cutting and weighing the plants at the time the experiment is concluded. All conditions of the experiment are so carefully controlled that the average result of 5 baskets rarely differs more than 5 per cent from the average result of any other 5 baskets that have been treated throughout in precisely the same manner. Differences which occur beyond this amount may therefore safely be attributed to the different manurial treatments which have been given."

From the results obtained by this method the conclusion is drawn that "both barnyard manure and green manure are beneficial to this soil when in a run-down condition, but that the effects from applications of green manure are decidedly more beneficial in that they are more lasting than for equal amounts of barnyard manure. The benefits from liming are so obvious that they need no comment, while potash and nitrogen in combination with manure are sufficiently beneficial to justify their application, at least in amounts not to exceed 250 lbs. per acre, but the results do not seem to indicate that when applied alone they are of enough effect to warrant their use."

These results "appear to be in harmony with the actual field experience of successful farmers in the locality."

How can we maintain the fertility of our Colorado soils? W. P. HEADDEN (*Colorado Sta. Bul. 99, pp. 16*).—The purpose of this bulletin is stated to be "to present to the farmers of Colorado some of the most patent facts relative to the maintenance of the productiveness of their lands." It discusses in a brief popular way the origin of Colorado soils, their deficiences and the extent to which they have been exhausted, and various means of restoring and maintaining fertility, including the use of commercial fertilizers, barnyard manure, and green manures.

It is stated that the soils of the eastern slope of the Rocky Mountains in Colorado are for the most part light sandy loams derived from the disintegration of the mountain rocks, which are essentially granitic in character. They are not particularly rich in potash and phosphoric acid, but nearly all of them contain as much as 0.1 per cent of nitrogen, which is considered the standard for a fairly productive soil. The climatic conditions, however, are not especially favorable to the formation of humus, the tendency being toward a burning up of the organic matter rather than its humifaction.

Considering the geographical position of the State and its remoteness from supplies of the chemical fertilizers (potash salts, nitrate of soda, etc.), there is serious doubt whether these materials can be profitably used for maintaining or increasing the fertility of the soils. The use of barnyard manure "is one of the most important and at the same time available means for the maintenance of the productiveness. . . . The next best method is probably that of green manuring, and for this purpose we have no better plant than alfalfa."

Soil fertility, W. C. WELBORN ([*Philippine*] *Bur. Agr. Bul. 6, pp. 13*).—A popular discussion of means of maintaining soil fertility, with suggestions as to the specific fertilizer requirements of the principal Philippine crops and the need of fertilizer laws in the Philippines.

Fertilizers registered for sale in Arkansas during 1905, A. M. MUCKENFUSS (*Arkansas Sta. Bul. 86, pp. 53–57*).—Actual and guaranteed analyses of 72 samples of fertilizers examined by the State chemist are reported.

Analyses of fertilizers, C. A. GOESSMANN (*Massachusetts Sta. Bul. 103, pp. 20*).—This bulletin includes directions for sampling fertilizers; instructions to manufacturers, agents, etc.; a discussion of trade values of fertilizing ingredients for 1905; and analyses of miscellaneous fertilizing materials, including wood ashes, nitrate of soda, cotton-seed meal, dried blood, sulphate of ammonia, clover roots, potash salts, acid phosphates, fish fertilizers, oyster-shell lime, paper-mill dustings, wool dustings, wool waste, cotton waste, cotton-waste compost, sewage-bed sludge, sewage, sheep manure, tobacco stems, tobacco dust, wood charcoal, salt-marsh mud, muck, peat, and soils (18 miscellaneous samples).

Analyses of commercial fertilizers and manurial substances, C. A. GOESSMANN (*Massachusetts Sta. Bul. 104, pp. 28*).—Analyses are reported of licensed fertilizers and miscellaneous fertilizing materials, including wood ashes, potash salts, German peat moss, river mud, wool-mill refuse, charcoal, boneblack, nitrate of soda, cotton-seed meal, barnyard manure, hen manure, and soils (19 miscellaneous samples).

Report on official inspection of commercial fertilizers and agricultural chemicals during the season of 1904, C. A. GOESSMANN (*Massachusetts Sta. Rpt. 1904, pp. 94–103*).—The results of examinations of 525 samples representing 295 brands are summarized. Tables show the average composition of the different classes of all fertilizers analyzed, and the maximum, minimum, and average composition of special crop fertilizers. A schedule of trade values of fertilizing constituents and a list of licensed manufacturers and dealers are given.

Analyses of miscellaneous fertilizer materials, M. S. MCDOWELL (*Pennsylvania Sta. Rpt. 1904, pp. 124–136*).—Analyses of the following materials are reported and discussed: Muriate of potash, sulphate of potash, kainit, sylvinit, wood ashes, nitrate of soda, nitrate of potash, sulphate of ammonia, dried blood, ground bone,

tankage, boneblack, rock phosphate, basic slag, Peruvian guano, tannery ashes, flue dirt, land plaster, mixed fertilizers, and garbage ashes.

Commercial fertilizers, J. L. HILLS, C. H. JONES, and F. M. HOLLISTER (*Vermont Sta. Bul. 112, pp. 71–92*).—This bulletin contains analyses of samples of 57 brands of fertilizers, representing 1905 shipments in the hands of local dealers. A schedule of trade values to be used in Vermont in 1905 is also given.

Commercial fertilizers, J. L. HILLS, C. H. JONES, and F. M. HOLLISTER (*Vermont Sta. Bul. 116, pp. 143–244.*)—This bulletin reports and discusses analyses of 137 brands of fertilizers, representing the output of 13 companies, examined during 1905.

Only 71 per cent of the brands met their guaranties, 7 failed to give a commercial equivalent of their guaranteed composition, and 1 was far below its guaranty. The average composition of all of the fertilizers showed 8 per cent more plant food than was guaranteed. The crude stock used in the preparation of the fertilizers was found to be on the whole of good quality. The average selling price was $29.62, the average valuation $19.04. It is estimated that 56 cts. worth of plant food was bought for a dollar in average low-grade goods, 64 cts. worth in medium-grade goods, and 73 cts. worth in high-grade fertilizers, thus showing the economy of buying high-grade goods.

A table is given which shows the composition of different brands during the past 5 years. The purchase of fertilizers, systems of fertilization, methods of application, and kinds of plant food best suited to different purposes are discussed, and 80 formulas for different crops and crop conditions are given with suggestions as to their use.

Commercial fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 95, pp. XIV+15–68*).—This is a complete report of analyses of fertilizers inspected during 1904, including also information regarding the conduct of the fertilizer inspection, valuation of fertilizers, availability of nitrogen in fertilizers, etc., and the text of the State fertilizer law.

Manures, F. T. HOLBROOK and E. J. RUSSELL (*Jour. Southeast Agr. Col. Wye, 1905, No. 14, pp. 159–169*).—Analyses and descriptions are given of a number of samples of typical fertilizers available for use in the region of Wye, Kent, including guanos, fish manures, bones and bone products, meat fertilizers and other waste animal products, shoddy, hoof meal, lime and chalk, kainit, silicate residue, and mixed fertilizers.

On the relationship between the amount of oil in cake and the farmyard manure produced, G. J. GOODWIN and E. J. RUSSELL (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 187–207*).—This article reviews experiments made elsewhere which bear on this subject, and reports results of digestion experiments made at the Southeastern Agricultural College at Wye with 2 steers, to determine the influence of the quality of the oil cake fed upon the manure produced. The analytical results are reported in this paper. The results of field tests on potatoes of the manures produced are to be embodied in a future report.

The conclusions reached are that "(1) [the] analyses fail to reveal any difference between dung made from rich oil cake and that from poor oil cake, the rest of the ration being the same in both cases. . . .

"(2) When the dung, mixed with sufficient litter, was left under the bullocks and thoroughly trampled, the loss of nitrogen amounted to 15 per cent, a value closely in accord with the results of other English and of German investigators. . . .

"(3) The loss is more serious than it appears, for, in addition to the 15 per cent mentioned, a certain amount of the easily available ammoniacal nitrogen is converted into slowly available insoluble bodies. . . . The exact percentage changed can not be stated with accuracy. . . .

"(4) From the standpoint of the value of manure produced, peat moss is much better than straw as litter, owing to its higher nitrogen content and its greater power of absorbing ammonia. It contains, however, very much less potash, and, as farm-

yard manure has hitherto furnished the farmer's chief supply of this fertilizer, substitution of peat moss for straw would in many cases involve dressing the land with potash. Such dressings cost little, and would be more than paid for by the saving of nitrogen."

Utilization of blood in agriculture, A. GRAU (*Jour. Agr. Prat., n. ser., 10 (1905), No. 32, pp. 177, 178*).—It is pointed out that since each sheep yields about 2 kg. of blood and each head of cattle about 20 kg. of blood, which in the fresh condition contains 3 per cent of organic nitrogen, the importance of utilizing this by-product is obvious. Various methods which are applicable on the farm, such as absorption in peat, straw, etc., and treatment with about 3 per cent of lime are referred to and the method of commercial treatment of precipitation by heating and the addition of dilute acid and drying is described. Brief general directions regarding the use of this dried material as a fertilizer are given.

Lime nitrogen (*Jour. Bd. Agr.* [*London*], *12 (1905), No. 2, pp. 101, 102; Jour. Dept. Agr. So. Aust. 8 (1905), No. 12, p. 742*).—The method used by Frank in preparing this material is briefly described, with his directions regarding the use of it as a fertilizer. The experiments by Gerlach, Wagner, and others to determine the fertilizing value of the material are briefly referred to. The general conclusion drawn from these experiments is "that lime nitrogen is likely to prove a satisfactory nitrogenous manure."

Comparative experiments with lime nitrogen, nitrate of soda, and burnt lime on fodder beets, C. ASCHMAN (*Landwirt, 1905, No. 37; abs. in Chem. Ztg., 29 (1905), No. 42, Repert. No. 11, p. 156*).—In the experiments here reported nitrate of soda gave the largest yield. The lower yields resulting from applications of lime nitrogen are thought to have been due to the fact that the material was not worked into the soil to a sufficient depth. The crops grown with nitrate of soda contained the largest amount of dry matter but those grown with lime nitrogen contained the highest percentage of nitrogen compounds. The lime of the lime nitrogen was apparently not as effective in increasing the sugar content as burnt lime.

New land, lime, and litmus, W. A. SHERMAN (*Country Gent., 70 (1905), No. 2746, pp. 833, 834*).—An account is given of the use of lime (600–800 lbs. per acre) in restoring the productiveness of recently cleared acid pine land. Tests of the soil with litmus paper are reported, which indicate that the acid character of the soil was not overcome by the liming.

Liming experiments of the agricultural society of Saxony (*Deut. Landw. Presse, 32 (1905), No. 42, p. 361*).—A brief description is given of the plan of simple experiments with lime, which have been carried on in cooperation with farmers since 1899.

On the retrogression of soluble phosphates in mixed manures, G. GRAY (*Trans. Austral. Assoc. Adv. Sci., 1904, p. 157; Chem. News, 92 (1905), No. 2386, pp. 77–79*).—Experiments are reported in which a well-made superphosphate containing 17.74 per cent of soluble phosphoric acid was mixed with equal parts of bone dust, guano, basic slag, kainit, slaked lime, and ground limestone, and the amounts of water-soluble, citrate-soluble, and insoluble phosphoric acid determined from time to time.

The results show that with bone dust the amount of retrogession was small and the rate of change slow. The citrate soluble phosphoric acid increased at the expense of the insoluble. With a guano containing a small percentage of calcium carbonate the reversion was slow, only 7 per cent of the soluble phosphoric acid being reduced after 18 days. As in case of the bone dust citrate-soluble phosphoric acid was formed at the expense of the insoluble phosphoric acid. With a guano containing a high percentage of calcium carbonate the retrogression was considerable and proceeded not only to the stage of dicalcium phosphate but beyond this to form insoluble tricalcium phosphate.

With basic slag the reversion was rapid, over 50 per cent of the acid being in an insoluble form within 3 hours. Only about 7 per cent of the phosphoric acid was reverted in 18 days in the kainit mixture. In the slaked lime mixture 94 per cent of the soluble phosphoric acid was reverted within 3 hours and the whole amount present within 24 hours. Reversion was not so rapid with calcium carbonate as with slaked lime, but 80 per cent of the water-soluble phosphoric acid was converted into citrate-soluble acid in 24 hours.

Plant peculiarities as shown by the influence of sodium salts, H. J. Wheeler. (*Rhode Island Sta. Bul. 104, pp. 49-92, pls. 8, dgms. 12*).—This is a report on a continuation of observations and experiments, previous accounts of which with a partial résumé of literature are given in earlier reports of the station (E. S. R., 11, p. 915).

The experiments have been conducted since 1894 on 48 sixtieth-acre plats, one series of which was fertilized with various combinations of sodium chlorid and muriate of potash, another with sodium carbonate and potassium carbonate. One subseries with each of these fertilizer combinations was limed in 1894 at the rate of 2 tons of slaked lime per acre. The experiments reported in this bulletin were made in 1899 with certain plants which it was thought might perhaps be helped by soda and with others which seemed doubtful.

"The work of the first 5 years demonstrated conclusively that soda could not perform all of the functions possibly attributable to potash, for where soda was substituted entirely for potash the crops became poorer from year to year. During the earlier years also few reliable indications were afforded that sodium salts were of benefit so long as a full ration of potassium salts was used. One of the chief objects attained in the first 5 years was the exhaustion to a striking degree of the assimilable potash, thus preparing the soil for use in making more satisfactory trials of sodium salts than were possible before."

In 1899 each plat was manured as follows: Dried blood 1,020, dissolved boneblack 600, floats (finely pulverized phosphate rock) 480, and magnesium sulphate 420 lbs. per acre. Sodium and potassium salts were each substituted for the other upon some one or more of the 48 plats in "quarter," "half," "three-quarter," and "full" rations. The full rations of the sodium and potassium salts used were as follows: Sodium chlorid (common salt) 231.6, sodium carbonate (soda ash) 202.2, muriate of potash (80 to 85 per cent potassium chlorid) 331.8, and potassium carbonate (pearl ash) 300 lbs. per acre. Spring rye, golden millet, chicory, Bloomsdale spinach, white Strasburg radish, flat turnip, Mansbury barley, Norbiton Giant beet, Danvers carrot, Iceberg lettuce, white pea-bean, and Budlong turnip (ruta-baga) were used in the experiment.

The results without exception indicate that soda is not as efficient as potash as a plant nutrient. "It can not be disputed, however, that soda is of some use in some manner with many varieties of plants, when the supply of potash is quite limited, and also with at least a few varieties of plants even in the presence of a fairly abundant supply of potash. Whether sodium salts would be rendered useless with all varieties of plants if the supply of potassium salts were greatly increased is a point which is not as yet fully proved, nor is it fully clear as yet in just what manner the sodium salt has been helpful in this particular experiment. This is a question which will be considered later in connection with the chemical analyses of the crops.

"It may, however, be stated here that sodium salts seem to liberate at least phosphoric acid and potash, so that under certain circumstances they may act as indirect manures. They also appear under certain conditions to prevent plants from assimilating large amounts of potash in excess of their needs, thereby conserving the potash supply within the soil. It does not appear unlikely, when the supply of potash is limited, that sodium salts may aid in some degree in performing some function of potassium."

On those crops which were particularly benefited by liming (barley, beets, turnips) the alkaline carbonates, as a rule, proved more effective than the neutral salts, probably on account of their action in neutralizing the acids of the soil.

AGRICULTURAL BOTANY.

Quack and wheat grasses, L. H. PAMMEL (*Iowa Sta. Bul. 83, pp. 397-416, figs. 7*).—The author describes quack grass (*Agropyron repens*), giving an account of its history and distribution and notes on its character as a weed plant.

Its value as a forage plant is shown by tables giving the results of analyses of the plant cut at different periods of growth, and suggestions are given regarding the methods of extermination. The author claims that quack grass can be exterminated by proper methods of culture, which include early plowing, thorough harrowing, the removal of rootstocks, and the prevention of growth throughout one or more seasons. If this treatment is persisted in it is said that the grass may be entirely eradicated.

Notes are given on a number of species of Agropyron which are commonly called wheat grasses, together with descriptions of the plants and statements regarding their forage value. Among the species described are *Agropyron pseudo-repens*, *A. occidentale*, *A. tenerum*, *A. richardsoni*, and *A. caninum*.

Soil-binding grasses, L. H. PAMMEL (*Iowa Sta. Bul. 83, pp. 417-421, figs. 2*).—An account is given of investigations carried on along the line of the Chicago and Northwestern Railroad to protect embankments from washing.

Quack and wheat grasses were tested, together with a number of other plants which were believed to have some value in this respect. Quack grass proved well suited to use as a soil-binder, but its character as a weed makes it objectionable for some localities. Brome grass and blue grass planted on the north side of embankments, if properly handled, will produce a good sod in a few years.

For the south side the author recommends the planting of western wheat grass and Canadian blue grass. For binding shifting sands the author recommends the use of a number of native species of plants, some of which succeed very well for the purpose indicated.

Studies of Mexican and Central American plants—No. 4, J. N. ROSE (*U. S. Nat. Mus., Contrib. Nat. Herbarium, vol. 8, No. 4, pp. 281-339, pls. 10, figs. 6*).—Notes are given on a number of hitherto undescribed plants, many of the specimens having been obtained by the author in Mexico. A number of the species recorded are of some economic importance, and their value as ornamentals, etc., is indicated. The author presents synopses of several genera of Mexican plants, and gives technical descriptions of the species.

The useful plants of the island of Guam, W. E. SAFFORD (*U. S. Nat. Mus., Contrib. Nat. Herbarium, vol. 9, pp. 416, pls. 70*).—This publication is an elaboration of notes made by the author during a series of cruises while connected with the United States Navy. After describing the early history of the island, previous scientific explorations, and its physical conditions, an account is given of the vegetation of the island, the author grouping the different plants according to formations.

Notes are also given on the people inhabiting Guam, and the agricultural and other industries. The principal plants used for food, fiber, oil, starch, forage, etc., are described, and the distribution of these plants not only in the islands of the Pacific Ocean but in other tropical regions is indicated. Particular attention is given to the method of cultivating and propagating the more important species, and also the means adopted for the preparation of their products, such as arrowroot, copra, cacao, etc.

A descriptive catalogue is given of all the plants, the arrangement being alphabetical and the native names, as applied in Guam, Hawaii, the Philippines, and elsewhere, indicated.

The respiration of plants, H. Marshall Ward et al. (*Rpt. Brit. Assoc. Adv. Sci., 1904, pp. 344, 345*).—A report is given by a committee of the British Association upon investigations by F. F. Blackman and Miss G. L. C. Matthaei dealing with the effect of temperature and light upon the photosynthesis of leaves.

It was found that one of the important considerations of the experiments was that the leaves should all be kept under similar conditions of illumination and temperature for some time before the beginning of the experiment, and that the real internal temperature of the leaf should be definitely known. With these precautions, a series of experiments was conducted in which the temperatures ranged from −6° C. to 45° C., and it was found that for each temperature a maximal assimilation exists specific to that temperature.

The amount of light required to produce the specific maximal assimilation varies directly with the magnitude of the maximum. When the maximum is reached no further increase in illumination or in the amount of carbon dioxid supplied will augment the assimilation by the plant. The amount of assimilation is just determinable at −6° C., from which temperature it rises rapidly toward the maximum. At temperatures of about 38° C. the leaves are incapable of maintaining their high initial rate of assimilation for any considerable time. The higher the temperature the shorter the duration of the period of maximal assimilation, and it was found impossible to obtain the maximal value at temperatures close to 45° C., which was a fatal temperature for the plants under observation.

The relation between the carbon dioxid assimilation and various intensities of natural illumination was also investigated, determinations being made of the assimilatory value of natural illumination at dawn, midday, in sun and shade, during rain and storms, and at dusk, and it is shown that the diffuse light of the whole heaven compares favorably with feeble direct sunlight as an illuminant.

FIELD CROPS.

Report of the agriculturists, W. P. Brooks, F. R. Church, and S. B. Haskell (*Massachusetts Sta. Rpt. 1904, pp. 115–153, dgm. 1*).—During this season the general lines of investigation previously described were again followed (E. S. R., 16, p. 350). The experiments this year included 220 plats in the open field, 150 closed plats, and 278 pots in vegetation tests. The grass garden of the station includes 48 species and 7 varieties, most of them occupying 1 sq. rod of land.

Potatoes were grown this year in connection with the comparative test of different sources of nitrogen, and on the basis of yield secured the materials ranked as follows: Barnyard manure, nitrate of soda, dried blood, and sulphate of ammonia. Based on the increase in all the crops since the beginning of the experiment, as compared with the check plats, the relative rank of the different fertilizers was: Nitrate of soda 100, barnyard manure 83.6, dried blood 66.9, and sulphate of ammonia 56.9. The growing of soy beans has so far shown but little effect on the succeeding crop.

This year high-grade sulphate of potash appeared considerably superior to the muriate for rhubarb and cabbage. Silicate of potash gave a relatively very low yield of cabbage and of field and silage corn, while the nitrate and carbonate of potash gave relatively high yields. Results with different phosphates for corn indicated, as in previous years, a very low degree of availability for Florida soft phosphate.

The soil test with corn has now been in progress for 16 years, and during this time the land has been in corn 8 years and in grass 4 years. Corn was grown in succession the last 3 years, and the past year was excellent on all plats receiving potash every year. The plat receiving muriate of potash alone continuously yielded 47 bu. per acre, and the one receiving dissolved boneblack in addition yielded 53 bu., being a better yield than was obtained on the plat treated annually with 5 cords of barnyard

manure per acre. The importance of a liberal supply of potash in fertilizers for corn is pointed out by these results.

In the soil tests with grass and clover nitrate of soda, either alone or in combination, gave a large increase in the first crop. Potash without lime had but little effect. The use of potash continuously for 15 years, with a ton of lime per acre in 1899 and 1904, produced a marked effect on the proportion of clover and also on the total yield. The plat receiving dissolved boneblack and muriate of potash continuously produced the most profitable crop. The annual cost of fertilizers for the limed portion of this plat was about $7.50 per acre, and the yield of hay was 6,160 lbs.

This year the yields obtained where a fertilizer mixture rich in potash and a special corn fertilizer were used were practically equal, but the cost of production with the mixture rich in potash was a little over $5 per acre less than with the special corn fertilizer. In comparing the value in corn production of a moderate application of barnyard manure alone and of a small application used in connection with the application of sulphate of potash, the crops obtained under the 2 systems were equal in amount of stover, but the plats receiving manure alone gave an average of about 5 bu. of grain per acre more than the combination of manure and potash. The use of barnyard manure alone, however, proved the more economical.

On the grass lands receiving different fertilizer treatment in rotation, the average yield of hay was at the rate of 8,050 lbs. per acre for all 3 systems of manuring. The average yield in this test from 1893 to 1904, inclusive, was 6,718 lbs.

Spreading barnyard manure as hauled from the stable during winter was again compared with placing it in a large heap to be spread in spring. In 3 out of 5 tests the results were in favor of the winter application, but the difference in yield was insufficient to cover the difference in the cost of hauling, which amounted to $4.80 per acre. An application of nitrate of soda after harvesting the first crop of grass did not sufficiently increase the crop of rowen to make the practice profitable, possibly on account of a somewhat deficient rainfall.

The 49 varieties of potatoes under test ranged in yield from 104 bu. of merchantable potatoes per acre for the Clinton to 319 bu. per acre for Simmon Model. Given in the order of productiveness, the following varieties yielded over 260 bu. per acre: Simmon Model, Extra Early White Rose, Great Divide, Steuben, 1904, and Mills New Rose Beauty.

Field experiments for 1903, W. R. Perkins (*Mississippi Sta. Rpt. 1904, pp. 36–39*).—This is a report on the plat experiments conducted during the year.

Of 12 varieties of cotton the 2 leading were Edgworth and Prize, yielding 1,920 and 1,895 lbs. of seed cotton per acre, respectively, while Garrard Prolific and King Improved, standing at the foot of the list, produced, respectively, 1,382 and 1,505 lbs. per acre. As in previous years, the use of different fertilizers had but little effect. No rust appeared in the cotton this season, which is thought to be due to the good preparation of the soil and abundant moisture throughout the entire season.

Twelve varieties of corn were under test and the 2 leading varieties, Southern Snowflake and Mosby, yielded 75.1 and 73 bu. per acre, respectively; while of the 2 least productive varieties, Blount Prolific yielded 26.7 and Champion Early White Dent 42.6 bu. per acre. The use of fertilizers showed no appreciable increase in yield except where 2 applications of nitrate of soda were made.

A plat of wheat treated with 129 lbs. of nitrate of soda per acre yielded 1,948 lbs. of hay per acre, as compared with 948 lbs. on the check plat. Four plats of oats, receiving 100 lbs. of nitrate per acre, gave an average yield of 2,325 lbs. of hay, while 2 check plats yielded 1,437 lbs. per acre. Nine varieties of wheat ranged in yield from 3 to 10 bu. per acre, and duplicate plats produced from 2,800 to 4,000 lbs. of hay per acre.

Fourteen varieties of cowpeas varied in yield of seed from zero to 15 bu. per acre, Whip-poor-will being the leading variety. The same varieties following wheat on

good soil grew up with Johnson grass and yielded 2.6 tons of hay per acre. In a test with Johnson grass alone it was found that the use of cotton-seed meal and nitrate of soda as a fertilizer for this crop yielded a profit of $3.03 per acre, and that thorough preparation of the soil more than doubled the crop.

Six Japanese varieties of soy beans and Mammoth Yellow, a variety procured from seedsmen, were tested. Mammoth Yellow produced 4.5 tons of hay per acre with 40 per cent of moisture present. A yield of 24 bu. per acre was secured on a part of the field. A variety of Egyptian clover gave promise of value, and sorghum produced a better yield and a better quality of soiling than Kafir corn and milo maize. Experiments in growing Bermuda grass from seed were only partially successful. Alfalfa is reported as growing with success at the station. Thorough and deep plowing and frequent use of the harrow have given good results as a method of soil preparation.

Report of work at McNeill Branch Experiment Station, E. B. FERRIS (*Mississippi Sta. Rpt. 1904, pp. 40–42*).—The work of the station comprises the determination of crops and varieties best suited to the pine belt, the best use of fertilizers in connection with their culture, and the planting of certain crops in sufficient quantities to determine the commercial side of growing them. The crops under test include vegetables, fruits, corn, cotton, sugar cane, cassava, sweet potatoes, and forage crops. The results with these crops, which are in nearly all cases promising, are briefly noted.

[Report on field crops], J. H. SHEPPERD (*North Dakota Stat. Rpt. 1904, pt. 1, pp. 66–138, pls. 2*).—The customary description of the work of the agricultural department of the college and station in 1904 is given and the results of different experiments are reported.

During the season 51,000 individual plants, including wheat, oats, barley, flax, buckwheat, millet, alfalfa, emmer, spelt, rye, einkorn, and corn, were grown in the plant-breeding nursery. The record of the seed distribution from 1898 to 1904, inclusive, shows that 1,734.5 bu. of seed of different field and forage crops were distributed to 770 persons. Some of the reports from different parts of the State with reference to these seed trials are reproduced.

The results of red clover trials in cooperation with the Bureau of Plant Industry of this Department show that seed from Missouri, eastern Ohio, Russia, and Wisconsin made a much better showing than the seed from other sources. On September 10 the plats sown with seed from Missouri and Wisconsin looked especially favorable, while those sown with seed from Illinois and Russia were also promising.

Fifty-seven varieties of wheat were tested in 1904. No difference in hardiness or rust resistance was detected between the fife and blue stem wheats, while the durum varieties were very much superior to either in these respects. The leading varieties in the different classes were North Dakota crossbred fife, with a yield of 16.4 bu. per acre, North Dakota crossbred blue stem with 17.3 bu., and Black Don U. S. No. 1446 durum with 25.9 bu. per acre. The average yields of the best 6 varieties of wheat in each class for 1904 were as follows: Durum 23.5, fife 16, blue stem 16.9, and blue stem and fife 16.4 bu. per acre. Eleven out of the 12 varieties giving the largest yields this season came from the plant-breeding nurseries of the North Dakota and Minnesota experiment stations.

A comparison of the average yields of the best 3 varieties of durum wheat with fife and blue stem for 6 years gave an advantage of 4.85 bu. per acre in favor of the durum wheat. The average yields for the last 2 years, as well as the results with the best 5 strains of fife and blue stem were in nearly every case in favor of varieties coming from the plant-breeding nurseries. Four varieties of winter wheat sown in the fall of 1903 were completely winterkilled.

In a culture test corn land disked in the spring for wheat gave nearly 3 bu. more per acre than fall-plowed corn land, and fall-plowed land produced a little over 1 bu.

more per acre than spring-plowed land. The best quality of wheat was produced on the spring-disked ground. A test of sowing rape and wheat for fall pasture resulted in a little larger yield from the mixture. The rape made but a slight growth after the wheat was harvested until frost.

Of 35 varieties of oats, U. S. No. 5168 led in yield per acre with 75.4 bu., being followed by Sensation with 70 bu. The side oats required the longest period for maturing and were less affected by rust than the branching varieties. This season the earliest maturing variety gave the largest yield, but in general the late-maturing sorts produced uniformly larger yields than the early varieties. The largest average yield on record at the station, 74.3 bu. per acre, was produced by U. S. No. 5168, which has been grown for 3 successive years.

Twenty-four varieties of barley were tested, and of these 5 were new additions coming from this Department. The barley plats were very little affected by rust, while the adjacent oat and wheat plats on similar soil were badly affected by it. The best yields this season were obtained from Highland Chief and Chevalier, while for the last 2 seasons Highland Chief and Success stood first in average production.

Thirty-two samples of flax were grown, including 20 varieties furnished by this Department. The best yield for the season, 24.2 bu. per acre, was obtained from U. S. No. 10014. Of the varieties grown for a series of years, Select Russian stands first with an average yield of 20 bu. for 3 years. The fiber varieties gave small yields in comparison with the seed strains, and were not profitable for seed production alone.

In 1904 North Dakota emmer yielded 46 bu., and a variety from this Department 52.9 bu. per acre, the bushel being calculated at 40 lbs. The average grain production of different crops for 6 and 7 years was as follows: Emmer, 2,096 lbs.; barley, 2,025; oats, 2,035; wheat, 1,733; and durum wheat 1,883 lbs. per acre.

Notes are also given on experiments with buckwheat, millet, corn, potatoes, and peas. Buckwheat has not generally given good crops at the station. In seed production the millet varieties were a complete failure in 1904. Of the different varieties of corn grown the following, in the order given, stood first in the proportion of ripe ears produced or in the degree of ripeness attained: Wills Dakota, Gehu, North Dakota No. 1 (a variety bred up from Minnesota King), Northwestern dent, Golden dent, Bloody Butcher, and Longfellow. Corn planted in drills 30 in. apart produced the tallest plants, measuring 5 ft. 9 in. Corn sown in ordinary wheat drills 6 in. apart and thick in the row reached a height of only 3 ft.

The yield of air-dry fodder, in 7 years' experiments, was greatest from planting in 6-in. drills. Corn planted in hills in rows 22 in. apart gave much better results than corn in rows 42 in. apart. The test of planting corn at different distances in the drill, the width between the drill being uniformly 3½ ft., showed that nearly 34 bu. of ear corn was obtained with the plants at 6-in. intervals in the row, and that the yield gradually decreased as the intervals between the plants increased. The results of a test of planting corn in hills show that where 6 stalks were grown in a hill a higher yield of both ears and fodder was obtained during 5 years than from thinner plantings.

The percentage of ripe corn in the last 2 seasons was regularly reduced when more than 2 stalks were grown per hill. It was also noticed that the ears were shortened as the thickness in the hill increased, the variation in length being from 4¾ to 6¼ in. The results from 4 years' work in planting corn in drill rows on different dates show that plantings made May 23 and 30 in 6-in. drills reached the silking stage, while in the later plantings no ears were formed. Planting in 42-in. drills gave much the same comparative results as those obtained in 6-in. drills, but there was a greater difference in the degree of maturity of the early and late-sown plats.

The results of different methods of cultivation tried this year were in favor of giving shallow cultivation early and deep cultivation late in the season. The average for 5 years shows the greatest yield of fodder from shallow cultivation.

The Edgeley Subexperiment Station, O. A. THOMPSON and J. H. SHEPPERD (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 153–168*).—A general report on the work at the station in 1904. The plant-breeding nursery this season contained 19,500 individual plants, including barley, wheat, flax, buckwheat, millet, and oats.

The best yield of wheat, 35.2 bu. per acre, was obtained from Velvet Don, a durum variety. The best yield among the fife and blue-stem wheats was 13.9 bu., produced by Selected Powers and Selected 66 fife, and American blue stem. North Dakota emmer produced 67.9 bu. per acre, as compared with 65.3 bu. for Washington emmer and 60.1 bu. for Success, the best yielding variety of barley. Nine varieties of oats varied in yield from 27.5 to 85.7 bu. The best yielding varieties, in the order mentioned, were Silver Mine, Swedish Select, and Abundance, the last 2 producing each 79.2 bu.

In seed production Siberian and Selected Russian flax outranked Russian and Selected Riga, which produced the largest yields of straw. The best yields of corn fodder were secured from the following varieties: Minnesota Dent No. 13 3,630, Triumph 3,542, and Pride of the North 3,281 lbs. per acre. Of 15 varieties of potatoes Hammond Wonderful and Banner led in yield. Ten varieties of millet were tested, including Pencilaria and Japanese, both of which failed. The best yield was obtained from Red Orenburg, which produced 4,660 lbs. of hay per acre. An outline is given of a crop-rotation experiment carried on by the station, and work with brome grass and alfalfa is briefly noted.

Field experiments in Staffordshire and Shropshire and at the Harper-Adams Agricultural College (*Harper-Adams Agr. Col. Joint Rpt., 1904, pp. 1–10, 15–40*).—At the college fertilizer tests on 10 plats of meadow land showed that superphosphate was very active, and when given with sulphate of potash proved the most economical of the different applications in increasing and improving the herbage. Barnyard manure produced a coarse and rank growth of grass, and nitrate of soda gave no increase in yield. Among 12 varieties of oats Thousand Dollar ranked first in quality and Waverly in yield; and of 6 varieties of wheat Standard Red and Red Stand Up proved best in yield of grain and in quality of grain and straw.

Different fertilizer applications increased the yield of mangels, but produced a marked reduction in the sugar content. The largest yield was obtained with the use of barnyard manure, together with a complete dressing of commercial fertilizers. Yellow Globe, Yellow Intermediate, Golden Globe, Mammoth Long Red, Golden Tankard, and Sugar Mangel, given in the decreasing order of yield, stood first among 15 varieties, while in quality the order was approximately reversed. The dry matter in the different varieties varied from 10.35 to 13.33 per cent, and the sugar in the juice from 7.04 to 9.60 per cent. Sutton Sugar Beet grown in the test contained 20.17 per cent of dry matter and 13.86 per cent of sugar in the juice.

In studying the effect of premature seed production, or running to seed the first year of growth, it was found that normal roots contained 8.7 per cent of sugar, and roots which had run to seed 5.64 per cent. The age of the seed or injury to young plants did not seem to influence premature seed production. It was also noticed that the number of plants going to seed during the first year differed within the same variety. The character of the season was the only factor recognized with certainty, as it was observed that in dry and warm seasons the plants ripened quickly and showed a greater tendency to produce seed than in cold and wet seasons. In trials with swedes, Sutton Magnum Bonum and Garton Model ranked first in yield with over 23 tons per acre. A home-mixed complete fertilizer for this crop was much more economical than a ready-mixed fertilizer.

Cooperative experiments were carried out in Shropshire with potatoes and mangels. For potatoes a complete application of commercial fertilizers, either alone or with barnyard manure, proved most econominal. In a potato variety test Scottish Triumph, Royal Kidney, and Factor produced the highest yields. Scotch seed

potatoes produced much better yields than seed of the same varieties grown in the district the previous year. Whole tubers for seed gave a larger total yield than either sets with single eyes or plants from cuttings. The fertilizer tests with mangels showed a large increase in yield from the use of barnyard manure and commercial fertilizers. Of 6 varieties, Yellow Globe produced the heaviest weight of crop, but Golden Globe, Golden Tankard, and Sugar Mangel were superior to it in quality.

In Staffordshire cooperative fertilizer tests were made on grass land, and experiments were conducted with potatoes, mangels, and swedes. In the fertilizer tests on grass at Blurton 1 cwt. of nitrate of soda and 5 cwt. of basic slag per acre, applied singly, gave an increase of 5 cwt. of hay per acre, but when given together the yield was no greater than on the check plat. Barnyard manure produced a good increase, but was not profitable. At Knightley 10 tons of barnyard manure gave a large increase in yield, but the quality of the grass was reduced. The next largest increase was obtained with 3 cwt. of kainit and 1 cwt. of nitrate of soda per acre, and the same increase resulted where 5 cwt. of basic slag was given in addition. The use of 5 cwt. of basic slag alone per acre gave the increase at the lowest cost per cwt. of hay. The best results at Macr were secured from an application of barnyard manure, together with a complete dressing of commercial fertilizers.

Of 12 varieties of potatoes, Royal Kidney, Factor, and Up to Date gave the best yields and also ranked well in quality. In a fertilizer test the commercial fertilizers had little effect, and the heaviest yields were obtained from the use of 20 tons of barnyard manure per acre.

Memoranda of plans for arid farm investigations (*Utah Sta. Circ. 3, pp. 29, dgms. 6*).—This circular contains outlines of the arid farm investigations for 1905 on the 6 experiment farms established under the direction of the State legislature, and gives complete instruction with reference to conducting the experiments and to the management of the farms in general.

Effects of manures throughout rotations of crops, D. A. GILCHRIST (*County Northumb. Ed. Com., Bul. 3, pp. 15-22*).—Fertilizer experiments were conducted on a light sandy loam soil throughout 2 courses of a rotation.

In the first rotation turnips, oats, hay, and oats, and in the second, swedes, barley, hay, and oats were grown, in the order named. The standard application of commerical fertilizers per acre consisted of 1 cwt. of sulphate of ammonia, 5 cwt. of superphosphate, and 1 cwt. of muriate of potash, containing 25 lbs. of nitrogen, 75 lbs. of phosphoric acid, and 50 lbs. of potash, and the application of barnyard manure of 10 tons per acre.

Barnyard manure was of greater value than commercial fertilizers, but both were satisfactory. Where the 2 were used on the same plat it was found best to apply the manure to the swedes and to use the commercial fertilizers for the hay. Twenty tons of barnyard manure did not prove profitable, and doubling the quantity of commercial fertilizers was of benefit only when divided between the swedes and the hay. The omission of potash nearly obliterated the gains obtained from the application of commercial fertilizers. The use of 10 tons of barnyard manure made up the deficiency of potash in this soil.

Forage crops, E. R. LLOYD (*Mississippi Sta. Rpt. 1904, pp. 13, 14*).—Winter wheat was grown for hay and followed by cowpeas sown at the rate of 2 bu. per acre. The cowpeas came up with Johnson grass and gave 2 cuttings. The yield of hay from peas and wheat was 3.85 tons per acre, obtained at a cost of $3 per ton put into the barn. Oats were cut for hay in the dough stage and followed by Early Amber sorghum, sown at the rate of 2 bu. per acre.

Sorghum gave 2 cuttings, and the total yield for oats and sorghum was 6.25 tons per acre, costing $2.77 per ton in the rick. Two acres of alfalfa, which suffered to some extent from the lack of drainage, furnished pasturage for 14 pigs for 1 month

and yielded 6,541 lbs. of hay. Soy beans planted in April in rows 3 ft. apart and cultivated twice yielded 1½ tons of cured hay per acre.

Wyoming forage plants and their chemical composition—studies No. 1, H. G. KNIGHT, F. E. HEPNER, and A. NELSON (*Wyoming Sta. Bul. 65, pp. 52, pl. 1, figs. 18*).—The forage conditions of Wyoming are briefly discussed, and the botanical and general description and the analyses of green and air-dry substance of the following plants are given: Western wheat grass (*Agropyron occidentale*), northern wheat grass (*A. dasystachyum*), bearded wheat grass (*A. caninum*), slender wheat grass (*A. tenerum*), western couch grass (*A. pseudorepens*), Indian millet (*Eriocoma cuspidata*), yellow spear grass (*Poa lucida*), Buckley spear grass (*P. buckleyana*), rough fescue (*Festuca scabrella*), squirrel-tail grass (*Hordeum jubatum*), native hay, alfalfa (*Medicago sativa*), fringed brome grass (*Bromus ciliatus*), alkali meadow grass (*Puccinellia airoides*), Nelson needle grass (*Stipa nelsonii*), tufted hair grass (*Deschampsia cæspitosa*), Bodin vetch (*Astragulus bodini*), pretty milk vetch (*A. elegans*), woodland hedysarum (*Hedysarum philoscia*), winter fat (*Erotia lanata*), wire grass or Baltic rush (*Juncus balticus*), Nuttall saltbush (*Atriplex nuttallii*), tumbling saltbush (*A. volutans*), Australian saltbushes (*A. semibaccata*, *A. halimoides*, and *A. holocarpa*), and sweet or Bokhara clover (*Melilotus alba*).

[Experimental work upon weeds and forage plants], L. R. WALDRON (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 56–64*).—This study on the vitality of weed seeds is in continuation of previously described work (E. S. R., 16, p. 882).

In 1899 a quantity of weed seeds was buried at different depths to ascertain the effect of this treatment on germination. In June, 1904, samples of these seeds were dug up and tested. Over 200 seeds of French weed showed no germination at first, but when dried and tested again 3 months later nearly 90 per cent grew. Green foxtail seeds buried 5 in. gave a germination of 8⅓ per cent, and seeds buried 10 in. deep, 6⅔ per cent. Of 15 seeds of Kinghead buried 10 in. deep 4 germinated, while of the shallow seedings no growth was obtained. Wild mustard gave the following results from the different depths: Three inches 26⅔ per cent, 5 in. 16, 7 in. 27, and 10 in. 11 per cent. Wild buckwheat and wild oat seeds all decayed.

In some special observations on the French weed the following 3 classes of seed were studied: Seed gathered with grain and sown with it the following spring, seed from winter annual plants which falls to the ground in June, and seed from spring plants which falls to the ground in July. Not any of the seed germinated until September, which allows the plant to develop sufficiently to live over winter. It is concluded that this weed is pernicious only as a winter annual, and that proper harrowing before seeding and plowing the land in the spring will reduce its prevalence. Observations on peppergrass (*Lepidium apetalum*) and tumbling mustard (*Sisymbrium altissimum*) led to the same conclusion.

The relative aggressiveness of different weeds was determined by sowing on May 10, 1904, 800 seeds each of 6 different species—Russian pigweed (*Axyris amaranthoides*), tumbling mustards, wild mustard (*Brassica arvensis*), French weed, false flax (*Camelina sativa*), and ball mustard (*Nesla paniculata*). On July 19, when the plants had attained their maximum size, there were found 520 plants of false flax, 356 of wild mustard, 281 of Russian pigweed, 195 of ball mustard, 24 of French weed, and 3 of tumbling mustard.

The results of spraying weeds with different solutions indicated that Thistleine, a preparation for the destruction of weeds, has no special value over sodium arsenite or copper sulphate. The cost of this substance is also much more than either of the other chemicals. It is stated that if Canada thistles are killed by spraying, this is caused by the destruction of the foliage and not by a distribution of the poison through the plant. It was observed that a relatively long period of time elapses after spraying before the thistles again begin to grow, and this is considered as possibly

due to the surface of the ground retaining some of the poison. Quack grass was not very much affected by the use of any of the solutions.

Observations made on the growth of wild oats showed that the seed was ripe enough to grow 85 days from seeding and 8 days after blossoming. The ripe seed fell to the ground 15 days after blossoming, or 92 days from seeding. The author calls attention to the fact that since wheat at the station requires 100 days to reach maturity, the wild oats are certain to reseed themselves before the wheat harvest.

An inspection of grass and clover seed, L. R. JONES and W. J. MORSE (*Vermont Sta. Rpt. 1904, pp. 402-417, 533-546, figs. 2*).—Samples representing 735 lots of seed were secured by the station from dealers in all parts of Vermont, and the examination of the samples as to purity and germination were made by the Seed Laboratory of this Department and the results obtained are given for each sample. A summary of the examination is shown in the following table:

Purity and germination tests of grass and clover seeds collected in Vermont.

Seed.	Number of samples.	Agricultural Department standards.		Average purity of samples.	Average germination of samples.	Samples below standard of purity.	Samples below standard of germination.
		Purity.	Germination.				
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Timothy	222	98	85.90	98	88.0	32	23
Redtop	83	....	....	80	87.0	....	....
Kentucky blue grass	8	90	45.50	63	55.0	....	....
Orchard grass	11	90	....	55	56.0	100	....
Meadow fescue	1	95	85.90	92	46.0	....	....
Millets	103	99	85.90	96	90.0	....	....
Red clover	134	98	85.90	91	87.0	91	24
Mammoth red clover	30	98	85.90	90	85.0	98	12
Alsike clover	105	95	75.80	85	77.0	90	27
White clover	14	95	75.80	86	59.0	100	57
Crimson clover	4	98	85.90	96	12.0	....	....
Alfalfa	10	98	85.90	91	79.0	90	70
Rape	1	99	90.95	94	98.5	....	....

Nine lawn grass mixtures contained 86 per cent of pure grass and clover seed. The value of the samples of seed as a whole was reduced by a considerable amount of inert foreign matter, dirt, chaff, etc., by the occurrence of weed seeds and of foreign seeds of various kinds having more or less agricultural value, and by the low germination shown in various cases. Methods of testing seeds are briefly described, and some of the more important State laws regulating the sale of agricultural seeds are summarized, the Maine law being given in full.

Grain score cards, J. H. SHEPPERD (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 147-152*).—Outlines of the score cards used at the college in judging corn, wheat, oats, and barley are given.

Variety tests of wheat, oats, and potatoes, G. C. WATSON and A. K. RISSER (*Pennsylvania Sta. Rpt. 1904, pp. 183-196*).—The results of variety tests with wheat have been noted from another source (E. S. R., 16, p. 364). The varieties of oats and potatoes were grown on plats similar to those described for wheat.

Twenty varieties of oats were sown at the rate of 8 pk. per acre on April 20 and harvested August 5. The yields of grain ranged from 47.52 to 64.60 bu. per acre. The leading varieties, Czar of Russia, Japan, and Silver Mine, yielded 64.60, 63.66, and 63.09 bu. per acre, respectively. Long White Tartar led in weight per bushel, with 33.41 lbs. The heaviest yield of straw per acre, 3,447 lbs., was produced by Japan. This variety, under test for 13 years, has given an average yield of 49.66 bu. per acre. Among 4 varieties grown for 6 years Mortgage Lifter ripened about one week earlier than the others. From 1899 to 1903 White Maine, Fourth of July, and Heavy Weight Champion gave better yields of grain than Japan. Gold Giant Side and Czar of Russia stood first in yield among the varieties tested for 3 years.

In the potato tests for 1903 Carman No. 3 headed the list witn 270.2 bu., while White Mountain stood last with a yield of only 21.8 bu. per acre. The late varieties were much injured by blight, and this caused the low yield of White Mountain. Early Rose ranked second in total yield with 250.2 bu., and first in the production of marketable tubers with 221.2 bu. per acre. The largest proportion of marketable tubers was produced by Heath Medium Late Surprise and Heath Late Beauty, and the smallest proportion by New Bovee Seedling. The results for a series of years showed that Carman No. 1, Freeman, Enormous, Washington, White Giant, Hiawatha, Pride of Michigan, Extra Early Crusader, Heath Late Beauty, Heath Late Surprise, Heath Favorite, and White Mammoth have given good returns. A description of the varieties tested is given in tabular form.

Alfalfa in Vermont, J. L. HILLS and L. R. JONES (*Vermont Sta. Bul. 114, pp. 109–132, fig. 1, maps 2*).—This bulletin gives a description of the alfalfa plant, and presents notes on its culture, value, and uses. The results obtained by growing alfalfa in northern Maine, New Hampshire, northern New York, and Vermont, and the views of New England and Canadian experiment stations on alfalfa culture are briefly reported. Of 56 trials at as many different points in Vermont 12 were permanently successful. The best results in the State have so far been obtained in the Champlain Valley.

Improvement in the quality of barley in Austria, J. STOKLASA (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 1, pp. 1–69, pls. 7*).—The fertilizer requirements of barley are pointed out, the mechanical and chemical composition of some of the typical Austrian barley soils is described, and the results of experiments to determine the influence of the principal plant-food elements upon the quality of barley are reported. The experiments were conducted in the greenhouse and on the experiment field of the station, as well as by a number of farmers. A bibliography of books and articles relating to the subject is given.

The plants were grown on ordinary field soil and on fine sand, and the 3 essential plant-food elements were applied in combination in one series of tests and separately in others. The complete application increased the yield of grain 99.9 per cent and the yield of straw 58.7 per cent over the check tests. The use of phosphoric acid alone on the field soil gave an increase of 44.7 per cent of grain and 26.3 per cent of straw, and the use of potash salts also largely increased the yield. The grain from the pots receiving the complete application stood highest in starch content, with 76.52 per cent, and lowest in protein, with 10.18 per cent. Corresponding results were obtained on the fine sand. Chlorid of potash proved more effective than sulphate of potash.

In the series of pots receiving nitrate of soda alone the starch content ranged from 70.03 to 71.51 per cent, being about the same as in the check tests, while the protein content varied from 17.56 to 18.5 per cent. As compared with the no-fertilizer tests, nitrate of soda increased the yield of barley 38.4 and 29.7 per cent, and the yield of straw 45.1 and 55.5 per cent on the field soil and the fine sand, respectively. The increase in straw production due to the separate use of phosphate of lime, sulphate and chlorid of potash, and carbonate of lime and magnesia, ranged from 9.4 to 26.3 per cent on the field soil and amounted to 1.5 and 23.4 per cent for chlorid of potash and phosphate of lime, respectively, on the sand.

It is pointed out from these results that barley after sugar beets gives heavy yields of straw because the soil is well stocked with nitrogen, while the supply of phosphoric acid and potash is relatively low, and that by the application of these elements the yield of grain may be increased and that of the straw diminished.

A second experiment was conducted to determine the effect of potash salts on the development of plants. Soil samples from Aufinoves and Modian were used in pot experiments.

The pots were divided into 4 series of 10 pots each, one being the check series and the others receiving superphosphate and nitrate of soda, or superphosphate and chlorid of potash, or the 3 substances together. The check test with Auřinoves soil gave an average yield of 90.4 gm. of grain and 90.572 gm. of straw. The heaviest yield of grain, 142.549 gm., was obtained with the complete fertilizer, the yield of straw being 135.167 gm. Where phosphoric acid and potash were given the yield was increased to 128 gm., with a considerable increase in the starch content. This experiment indicates that although the soil was comparatively rich in available potash, the use of potash salts was beneficial.

In the case of the other soil, which contained less available potash, the check test yielded on an average 80 gm., the series of pots receiving superphosphate and chlorid of potash 178 gm., and the series with the complete application 188 gm., or a difference of 10 gm. apparently due to the nitrate of soda. It is concluded that leaching the soil with solutions of citric and oxalic acid points out whether or not potash may be profitably applied to the soil in barley culture.

In the check tests on both soils the proportion of hulls ranged from 11.37 to 12.86 per cent, and in the superphosphate and nitrate of soda series from 10.94 to 11.89 per cent; but when chlorid of potash was given in addition to the superphosphate it ranged from 8.64 to 10.04 per cent, and with the complete application, from 9.2 to 10.53 per cent. The starch content varied from 66.82 to 70.22 per cent in the check test, and where superphosphate was used, from 68.84 to 70.14 per cent; but when chlorid of potash was added it varied from 72.34 to 73.88 per cent. With the complete application a starch content of 72.85 to 74.10 per cent was recorded. The protein content of the barley was considerably increased by the use of nitrate of soda. In the superphosphate and nitrate of soda series of pots it varied from 12.35 to 12.73 per cent, but the application of chlorid of potash reduced it.

In the cooperative field experiments different combinations of superphosphates, nitrate of soda, and kainit at the rate of 250, 200, and 300 kg. per hectare, respectively, were applied. The results showed that 1 gm. of assimilable potash produced from 23 to 25 gm. of starch, and that the quality of brewing barley can be improved by supplying potash and phosphoric acid in the fertilizer, especially when the soil is rich in nitrogen compounds or when nitrate of soda is applied.

Analysis of individual stalks of corn, E. F. LADD (*North Dakota Sta. Rpt. 1904, pt. 1, p. 31*).—Analysis of 2 successive generations of 2 corn plants are given. The 2 lots of corn from the same parent seed showed a protein content of 14 and 14.5 per cent in 1903 and of 16.06 and 15.38 per cent in 1904.

The work on flax, H. L. BOLLEY (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 64, 65, pls. 3*).—This is a progress report on the work with flax, consisting of a comparative study of varieties and a test of their resistance to the wilt disease. The development and maintenance of immunity to the disease is described.

Fertilizer experiments with hemp, KUHNERT (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 14, pp. 99, 100*).—In 2 tests barnyard manure was applied alone and together with different combinations of Thomas slag, kainit, and nitrate of soda in quantities of 30, 25, and 15 kg. per hectare, respectively.

Given in addition to the manure, each substance by itself produced an increase in yield, but the best and most profitable returns were secured with the complete application. On the barnyard manure plats the average yield amounted to 1,890 kg. and on the plats receiving the complete application of commercial fertilizers in addition to 2,240 kg. of hemp per hectare. No difference in the quality of the fiber from the various plats was apparent.

The potato and its culture, W. T. MACOUN (*Canada Cent. Expt. Farm Bul. 49, pp. 48, pls. 2, figs. 6*).—This bulletin briefly notes the importance of potato culture in Canada, reviews the history of the plant and its improvement, summarizes the

experimental work with the crop at the Central Experimental Farm, and gives general directions for its culture.

The 12 most productive varieties grown at this farm for 5 years are as follows: Dr. Maerker, Late Puritan, Burnaby Mammoth, Money Maker, Carman No. 1, Dreer Standard, Sabean Elephant, Canadian Beauty, Rural Blush, I. X. L., Pearce, and Clay Rose. The 6 most productive early varieties for 5 years were Irish Cobbler, Early Elkinah, Vick Extra Early, Rochester Rose, and Rawdon Rose.

Some of the earliest varieties are Early Snowball, Eureka Extra Early, Burpee Extra Early, Rochester Rose, Bliss Triumph, and Early Ohio; and the 12 varieties freest from blight are Dr. Maerker, Late Puritan, Burnaby Mammoth, Carman No. 1, Dreer Standard, Sabean Elephant, Rural Blush, Clay Rose, Rose No. 9, Holborn Abundance, State of Maine, and Swiss Snowflake. From 1887 to 1905 about 844 varieties have been tested at the Central Experimental Farm.

In a 3-year test of growing potatoes after clover an average increase of 37 bu. per acre was obtained, as compared with growing potatoes without the use of clover. For fertilizing the land for potatoes the author recommends the use of a moderate quantity of barnyard manure applied on the clover in the fall, or of well rotted manure used in the spring, or if commercial fertilizers are used, an application of 500 to 800 lbs. or more per acre in the proportion of 250 lbs. of nitrate of soda, 350 lbs. of superphosphate, and 200 lbs. of sulphate or muriate of potash. An increase of 40 bu. per acre was obtained in a crop cultivated 6 times as compared with one cultivated only 3 times. In a 3-year test spraying with Bordeaux mixture apparently increased the yield 94 bu. The cost of growing an acre of potatoes yielding 300 bu. is estimated at $52.14.

Variety tests with potatoes in 1901–1904, G. MARTINET (*Ann. Agr. Suisse, 6 (1905), No. 5, pp. 179–198, figs. 2*).—The yields and descriptions of a large number of varieties of potatoes are given in tables. In 1902, 2 plants were selected for their productiveness and the quality of their tubers, but one was superior in yield and quality to the other. The seed of these 2 plants grown for comparison showed a difference in yield of 32.7 per cent in 1903 and of 41 per cent in 1904 in favor of the seed from the best plant.

Solanum commersoni and its variations at Verrières, LABERGERIE (*Ann. Sci. Agron., 2 ser., 10 (1905), I, No. 1, pp. 57–139, figs. 12; abs. in Jour. Agr. Prat., n. ser., 8 (1904), Nos. 51, pp. 803–807, figs. 4; 52, pp. 831–834, figs. 2*).—This is a report of work with *Solanum commersoni* and includes notes on observations made in cultural tests with this plant by other investigators.

Experiments have been in progress since 1901, and the results have shown that the characters of the primitive types are readily influenced by cultivation and selection. In very fertile friable soil, varying with the time the plants had been established, the yields ranged from 20,000 to 27,000 kg. per hectare and in sandy soils the yields, owing largely to the dryness of the soil, ranged from only 4,500 to 16,000 kg. per hectare. The plant grew well on dry soil, but produced very long stolons with the tubers from 20 to 30 cm. beneath the surface. The resistance to disease was good and the tubers showed perfect keeping qualities. Tubers grown in 1904 on fertile soil contained 19.91 per cent of starch and 72.59 per cent of water, and those grown on poor sandy soil 23.21 per cent of starch and 67.48 per cent of water.

Descriptions are given of variations observed in 1904, comprising varieties with yellow, white, and violet tubers. The violet variety appeared to be of value on fertile and humid soils, absolutely disease-resistant, very productive, and of good quality. A dozen plants this season produced tubers varying in color from almost white to a deep red. Six of these plants produced these variations, together with the violet tubers, on the same stolons.

Correlative changes in rye breeding on the basis of color in the grain, K. VON RÜMKER (*Fühling's Landw. Ztg., 54 (1905), No. 7, pp. 238–245*).—Experiments

in breeding Petkus rye by selecting differently colored grains for seed are briefly reviewed, and the results secured up to date are summarized.

Green-colored grains showed an indefinite transmission of the color, the progeny varying from green to a dull gray. As the dullness of the color in the kernel became more distinct the power of transmitting the color was apparently decreased. Yellow kernels did not readily transmit their color, but in some stools it was found to be very definite and showed regular progress. Bluish and brown veins were very strong in transmission of color.

Plants from short grains showed a marked reduction in the length of the straw. The longest straw was produced by the green-colored grains, followed by the blue, yellow, and brown kernels, mentioned in decreasing order. The green-colored grains produced a softer and looser straw than the other forms, while the straw from blue kernels was tough and hard. The best formed culms and heads were found in the plants from blue seed. In weight of grain the brown group stood last.

Data on the comparative winter resistance of the different strains, obtained only for the season of 1903, showed that the blue seed ranked first with 84.66 per cent, and the short seed last with 66 per cent of the stand secured in the fall.

Method of tobacco-seed selection, W. W. Cobey (*Maryland Sta. Bul. 103, pp. 225–235, figs. 4*).—This bulletin contains popular directions for the selection of seed plants in the field, and the method of bagging the flower heads and securing the seed. The work in tobacco-seed selection at this station is carried on in cooperation with the Bureau of Plant Industry of this Department.

Tobacco experiments, W. Frear (*Pennsylvania Sta. Rpt. 1904, pp. 30–39, pls. 12*).—The work here reported represents shelter-tent experiments with Sumatra leaf.

The site and the soil under which the experiments were conducted are described and the method of constructing the tent over one-half acre of ground, with the outlay involved, is given in detail. The planting, cultivation, harvesting, curing, and sweating of the crop are briefly discussed and the results are reported. The weight of the cured leaf produced was 856 lbs., which was reduced to 814 lbs. by sweating. The sorting of the leaf as to color and size gave the following results: First quality—light, 7.5 per cent; medium, 22 per cent; dark, 12.9 per cent. Second quality—light seconds, 18.6 per cent; dark, 13.5; trash, 25.5 per cent.

After the finishing sweat the tobacco was compared with Connecticut tent-grown Sumatra of the same season. There was no apparent difference in the quality of the 2 lots, neither of which was considered equal to the imported article. In the opinion of the author the results at present do not warrant the encouragement of this method of culture, but indicate the desirability of continuing the experiments in a more favorable season and possibly on lighter soil.

Experiments with fertilizers on tobacco, C. E. Thorne (*Ohio Sta. Bul. 161, pp. 213–228, figs. 2, dgms. 2*).—Notes on the establishment of a test farm in the Miami Valley to be devoted chiefly to work with tobacco are given, the plan of the fertilizer experiments inaugurated is outlined, and the results thus far obtained are reported.

In one series of experiments the tobacco is grown in a 3-year rotation with wheat and clover, and in a second series it is grown continuously on the same land. As the experiments have just been begun, only the most general conclusions are drawn. Barnyard manure proved very effective and profitable. Commercial fertilizers also produced a good effect, but the net gain was not so large as from barnyard manure.

The results show that the greatest total yield and net profit were produced by a fertilizer containing nitrogen, phosphoric acid, and potassium, in approximately the ratio to each other in which they are found in barnyard manure. The large quantity of nitrogen required in this application greatly increased the cost. As a carrier of nitrogen, nitrate of soda appeared much more effective than tankage.

Experiments in fertilizing tobacco, C. Dusserre (*Ann. Agr. Suisse, 6 (1905), No. 5, pp. 199–203*).—A cooperative study was made of the effect of sulphate and

carbonate of potash used alone or with superphosphate. The quantities used per hectare were as follows: Three hundred kg. of sulphate of potash; 246 kg. of carbonate of potash, in quantities furnishing 150 kg. of potash; and 500 kg. of superphosphate containing 75 kg. of phosphoric acid. A general dressing of barnyard manure was given at the first plowing in the spring.

In one of the tests superphosphate increased the yield of leaves, and sulphate and carbonate of potash also produced a small increase. A second test gave inconclusive results in this connection. The proportion of phosphoric acid in the leaves was not at all increased in one test and but slightly in the other by the use of phosphatic fertilizers. The lime content was slightly increased in the product from land fertilized with superphosphate.

The use of potash salts increased the potash content of the leaves. The superphosphate produced large leaves of good maturity and of good strength, while the influence of potash salts was less marked. In general, the fertilizers applied did not appreciably affect the burning quality.

Winter wheat, T. L. LYONS and A. KEYSER (*Nebraska Sta. Bul. 89, pp. 52, fig. 1*).—The results of variety tests of winter wheat in 1902, 1903, and 1904, conducted in cooperation with this Department, are described. Among the varieties tested 4 were from Hungary and a large number from Russia. Previous accounts of these varieties are recorded in a former bulletin (E. S. R., 14, p. 36).

The results in general indicate that the variety best adapted to Nebraska is Turkish Red, although Kharkof, one of the new Russian sorts, has proved hardier in the extreme northern part of the State. Several of the Hungarian varieties, although somewhat better in quality than Turkish Red, are later in maturing and consequently less productive. It is reported that these late-maturing Hungarian and Russian wheats are becoming earlier and may, therefore, be of value.

The observation of the station with reference to "yellow berry" in hard winter wheat has led to the conclusion that the chief causes of this condition are allowing the wheat to become overripe and the failure to stack the sheaves. As compared with the hard, red normal kernels, these kernels or "yellow berries" have a lower gluten content and are lighter in weight.

Tests of seed wheat from various sources resulted in the best yields in every case from locally grown seed of the same variety. In this test locally grown Turkish Red seed yielded better than imported Crimean for each of the 3 years tested. Turkish Red seed from western Kansas yielded nearly as well as Nebraska-grown seed and was of better quality during the dry years, but suffered more from scab or blight in 1903 and 1904.

The importance of good tillage was shown by growing very poor seed wheat on well-tilled land, which resulted in a yield of several bushels more per acre than the average of the county or State for each of 3 successive years. This favorable result is ascribed to the rotation of crops, the use of barnyard manure, and good tillage. In studying the effect of season and climate on the composition it was found that wheat stores up more nitrogen in the form of protein in dry seasons and more starch in wet seasons.

The yautias, or taniers, of Porto Rico, O. W. BARRETT (*Porto Rico Sta. Bul. 6, pp. 27, pls. 4*).—This bulletin gives a description of these plants in general and of the various types in particular.

The cultivated varieties of Porto Rico are classified under the following 6 types: Blanca, Manola, Amarilla, Martinica, Vino, and Violacea. The semicultivated varieties and the so-called false yautias are also noted. Cultural directions are given and the uses of the plant are described. The plant proportions of the principal varieties are reported as follows:

Proportions of different parts of the yautia plant.

Variety.	Leaves.	Root-stock.	Offsets.	Tubers.	
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Per cent.*
Amarilla	7.25	2.5	4.25	1.5	10
Guayamera	4.5	2.0	1.75	2.5	21
Martinica	6.0	1.25	1.75	2.5	22
Rolliza	3.5	2.25	1.50	3.75	34

The composition of 2 samples of yautias determined at the Maine Experiment Station is compared with the composition of Irish potatoes and sweet potatoes in the following table·

Composition of yautias and potatoes.

Yautia and potato.	Water.	Protein.	Fat.	Total carbohydrates.		Ash.	Fuel value per pound.
				Sugar, starch, etc.	Crude fiber.		
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
White yautia	70.0	1.7	0.2	26.3	0.6	1.2	529
Yellow yautia	70.0	2.5	.2	26.1	.6	.6	538
Irish potato	78.3	2.2	.1	18.0	.4	1.0	385
Sweet potato	69.0	1.8	.7	26.1	1.3	1.1	570

A sample of dried tubers of the Rolliza variety, analyzed by the Bureau of Chemistry of this Department, contained 29.17 per cent of starch and 62.25 per cent of moisture. This is considered an exceptionally high percentage of starch, but it has been found in experiments with this variety that 20 to 25 per cent of starch is readily obtained from fresh roots. The yield of starch per acre is estimated at from 8 to 15 tons, as compared with 5 to 10 tons for cassava. Yautias dried and ground yield about 30 per cent of flour at a cost of about 2 cts. per pound for the raw material. Less than 5 per cent of the gross weight of the yautia tuber is lost in peeling.

HORTICULTURE.

Report of the horticulturists, F. A. Waugh and G. O. Greene (*Massachusetts Sta. Rpt. 1904, pp. 157–167, dgm. 1*).—Reports are here given on plums and the pruning of peach trees.

The report on plums deals principally with the behavior of a large number of varieties grown at the station. Bradshaw has proved one of the best of the Domesticas grown, while Burbank, of the Japanese sorts, has proved the most profitable and productive market plum at the station.

Experiments were made in marketing plums in 3-lb. baskets such as are used for grapes. This proved a satisfactory package, as it furnished about the quantity of fruit desired by most purchasers.

Plums for canning were packed in Jersey peach baskets holding 16 qts. This proved a satisfactory, cheap, and convenient package. Most markets were found not to be fastidious with respect to the form of the package used for plums, and any small neat basket or box will answer if the fruit is of good quality and well packed.

In pruning experiments with peaches one row has been left for 9 years without pruning. These trees are quite open-headed and have generally assumed a vase form. The lower part of the main branches is bare and the fruiting wood is sparse, weak, and high up in the trees. The trees are much less thrifty and vigorous than

pruned trees of the same variety. As a result of this lack of vigor a number of trees succumbed to the cold during the preceding winter.

A row of trees next to this has been headed back moderately 2 or 3 times, as a result of which they are thick topped, with a good deal of weak, sappy growth on the inside. The annual growth, however, has been much more vigorous and the health of the trees better than those not pruned. More and stronger fruit buds have also formed. The main fruit branches are shorter and stronger and more capable of sustaining a large crop of fruit. The experiment is believed to show conclusively that the best form of peach tree can not be secured and maintained without pruning.

During the past 3 years a special experiment has been made in heading back peach trees in the spring. The conclusion reached relative to this work is that "the heading back of peach trees in early spring is good practice and in all cases advisable. In this pruning from one-third to two-thirds of the wood of the previous year should be removed," depending upon the number of living fruit buds on the 1-year-old wood. When from any cause there are no fruit buds advantage should be taken to cut back with comparative severity. Only in extraordinary instances, however, should the cutting extend back into 2 or 3 year old branches.

Some experiments were made in summer pruning peach trees. With early spring pruning it had been noticed that many weak and useless shoots grew in the center of the tree. It was thought that if a considerable quantity of the new leafy shoots on the outside of the tree were removed, thus admitting a reasonable amount of light to the inside of the tree top, some benefit might result.

"In no case were the results of this treatment convincing. The formation of strong shoots with fruit buds on the interior branches was never visibly promoted. The outside branches which were allowed to remain seemed to profit somewhat by the removal of their crowding neighbors, and this was apparently the chief benefit derived from the work. On the whole, it does not seem to us that this practice is to be greatly recommended."

Cutting back the young growth of the outside branches to correct overgrowth did not give satisfactory results. The stopping of the growing shoots was usually followed by the pushing out of side buds and shoots lower down which were nearly always too weak to set good fruit buds.

Considerable winter injury was sustained by peach trees in both 1903 and 1904. The damage was not serious in 1903, but in 1904 the trees were seriously weakened by freezing, and some were killed outright. In treating the injured trees one block was left entirely without pruning, another was pruned in midsummer after the trees had started; a third was cut back from two-thirds to three-fourths of the previous year's growth, and a fourth was headed back near to the trunk, only the stubs of the main branches being left. The following table shows the results:

Effect of different methods of pruning frozen peach trees.

Method of pruning.	Total number pruned.	Living autumn of 1904.	Dead autumn of 1904.	Living.
				Per cent.
Trees unpruned	121	113.0	8.0	93
Moderately cut back	48	47.5	.5	99
Severely cut back	68	55.0	13.0	81
Cut back to stubs	46	24.0	22.0	52

While a large number of the unpruned trees lived, the growth made by the headed-in trees which lived was much better than that made by the unpruned trees. It was the judgment of many who saw the trees that the trees moderately cut back showed the best growth and were in the best condition. The experiment is

also believed to point out that trees seriously weakened by freezing should not be cut back close to the main trunks.

Horticultural department, C. B. WALDRON (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 171-178*).—An outline is given of the work of the year with vegetables, orchard and small fruits, trees, etc.

Special attention is called to the value of mulching orchard fruits as a means of preventing winterkilling. If a mulch is applied too early it induces a late fall growth. If not applied until the ground is frozen to some depth but little good is accomplished. For satisfactory results it should be applied before the ground begins freezing. It should be applied to a depth of about 6 in. and to a distance of 4 or 5 ft. from the tree. Where mulching is practiced some precaution must be taken to prevent injuries from mice. Wrapping the trees with burlap or with tar paper has given good results. Not only has mulching been efficient in preventing winter injury but the mulched trees also made 25 to 30 per cent more growth than unprotected trees.

Observations on the Hessian fly indicate that it is two-brooded. Macaroni wheat appears to be free from attacks of this insect.

Report of the horticulturist, W. STUART (*Vermont Sta. Rpt. 1904, pp. 418-445, figs. 6, dgms. 2*).—A general review of the work of the year

The peculiar behavior in the spring of many apple trees in different sections of the State is noted. These trees blossomed and partially or wholly leaved out, after which growth was arrested and the leaves withered and dried up. Later on most of the trees pushed out many new shoots at the base of the scaffold limbs or on the trunk just below their juncture with it. Careful examination of these trees by the author led to the belief that the injury was due to root killing caused by the abnormally cold winter of 1903-4. The trees most seriously injured were 8-year-old Rhode Island Greenings.

In the winter forcing of tomatoes tests were made of the relative earliness and productiveness of Sutton Best of All, New Stone, and Lorillard. Sutton Best of All gave a slightly heavier yield of ripe fruit for the first few pickings than New Stone, but over a period of 5 or 6 weeks the results were uniformly in favor of New Stone. "In one season's trial Lorillard proved superior in every respect to Sutton Best of All. Lorillard is apparently the earliest and most prolific for forcing purposes of the 3 varieties tested."

Investigations were also made as to the relative value of chemical fertilizers and rotted manure for tomatoes in winter forcing. "The average weight of large fruits for the 2 seasons was 90.4 gm. from chemical fertilizers and 92 gm. from rotted manure. On the same basis the average number of large fruits per plant from the chemical-fertilizer sections was 17.3 as against 18.3 from plants grown in rotted-manure sections. This shows an average gain in weight of fruit per plant of nearly 8 per cent in favor of the rotted-manure sections." The greatest number of large fruits early in the season was also secured from the section which had been fertilized with rotted manure.

The studies in indoor lettuce culture involved a comparison of different forms of chemical fertilizers and of chemicals and rotted manure for lettuce. The average yield of fruit per plant was as follows: Plat (1) fertilized with acid phosphate, nitrate of soda, and muriate of potash, 133 gm.; (2) acid phosphate, dried blood, and muriate of potash, 131 gm. (the comparison in these 2 instances being made between nitrate of soda and dried blood); (3) dissolved boneblack, nitrate of soda, and muriate of potash, 137 gm.; and (4) raw bone meal, nitrate of soda, and muriate of potash, 153 gm. Plats 3 and 4 are to be compared with plat 1, mentioned above, and with each other.

The results show that there is very little choice between dried blood and nitrate of soda as a fertilizer for this crop, while raw bone meal produced a decided increase in

the weight of the product. A soil liberally dressed with rotted manure gave slightly better results than commercial fertilizers. During 2 seasons comparisons were made between the yield of lettuce on surface-watered and subwatered sections. The results for the 4 crops grown during the 2 seasons are without exception in favor of subwatering, the average increase being about 15 per cent.

During the preceding winter a number of trees in the orchard were girdled by mice. The following spring many of these were bridge grafted by students in the junior class. Trees thus treated grew successfully, while untreated trees died. Illustrations are given of treated and untreated trees.

A test was made during the winter of the value of ether in forcing rhubarb. The rhubarb roots were dug in the fall and placed in a cold frame where they were subjected to the action of frost in the usual way. A part of 4 separate lots was etherized, the first lot, December 18–20; the second, January 9–11; the third, January 30 to February 1; and the fourth, February 24–26. Sulphuric ether was used at the rate of 10 cc. per cubic foot in all cases except with the third lot, where 17 cc. was used.

The first and second lots which were etherized gave results decidedly in favor of the process. The third lot, which received 17 cc. per cubic foot, was injured by the treatment, while the fourth lot was etherized so late in the season as not to show marked benefits from the treatment. The increased yields in lots 1, 2, and 4 were 34.4, 89.7, and 5.7 per cent, respectively, in favor of etherization, while in lot 3 the untreated plants gave an increased yield of 26.8 per cent over the etherized plants.

Considering only the 3 lots which are strictly comparable, the gain in favor of the etherized plants for the different pickings was as follows: First picking, 622 per cent; second, 86 per cent; third, 23 per cent; and fourth, 47 cent. These results show a decided increase in earliness and in weight of product due to etherization. It is believed that still better results might have been obtained had the work been undertaken a month or 6 weeks earlier. Forcing took place under the benches in the greenhouse in darkness.

The real Luther Burbank, E. J. WICKSON (*Sunset Mag., 15 (1905), No. 1, pp. 3–16, pl. 1, figs. 11*).—Besides an account of Burbank himself, his methods of work, and the results accomplished, the origin of some of his productions is noted.

The Burbank plum was a direct importation from Japan. The crimson winter rhubarb was imported from Australia. The sugar prune is a seedling of the prune d'Agen. The crimson California poppy was obtained by selection from the yellow California poppy. The improved "everlasting" flower was obtained from the star flower from Australia (*Cephalipterum drummondii*). This flower "has undergone selection for size and color of its paper-like bracts, until they have become large, rosy within and white without, and have similated the structure and texture of artificial flowers to such an extent that manufacturing milliners talk of its use by the million as serving the same end with much more grace and less cost than their cloth-and-wire creations."

The Wickson plum was produced by crossing Burbank and Kelsey. The stoneless prune was obtained by crossing an European species, "which has never been of horticultural value," with the French prune, followed by selection. The Shasta daisy was obtained by combining the moon daisy of Europe, the ox-eye daisy of America, and a species from Japan, and selection. The spineless cacti has been evolved by hybridization and selection between 5 species of opuntia.

Bud variation. Facts that prove its occurrence, O. W. BLACKNALL (*Country Gent., 70 (1905), No. 2717, p. 179*).—The author cites examples of bud variation with the Winesap apple, the Scuppernong grape, and the Wilson Albany strawberry. Having proved satisfactorily to himself that bud variation does occur, he suggests as a practical result in propagating fruit trees and all other plants by means of buds that the scions should be taken only from plants of highest productivity.

Asparagus growing in Arkansas, E. WALKER (*Arkansas Sta. Bul. 86, pp. 37–46*).—Asparagus is very little grown in Arkansas, only 1 acre being credited to that State by the United States Census of 1900, and the author believes it should be brought more extensively into use. Detailed directions are given for cultivating asparagus for the home and market, with suggestions for the control of insect pests and fungus diseases.

Asparagus and salt, E. WALKER (*Arkansas Sta. Bul. 86, pp. 31–36*).—In order to determine the value of salt in asparagus culture, one-half of a bed of 4 varieties of asparagus covering a total of one-seventh of an acre was fertilized with salt at the rate of 1,000 lbs. per acre.

The asparagus field was in its second year at the time the experiment was started. No cutting was done during that season, but as far as could be seen there was no appreciable effect of the salt upon the growth of the plants nor in preventing the growth of weeds. The following spring the portion of the plat which had received salt the preceding summer was again salted and this time at the rate of 2 lbs. per square yard applied in 2 equal applications at intervals of 20 days.

With each variety larger stalks and an increased yield were secured where the salt was applied, the average increase being 13.5 per cent in favor of the salted area. Not only was the growth increased in the spring, but there was also an increased vigor manifested in the plants throughout the summer, and a notably increased glaucous appearance in the salted plants. The salt was entirely effective in preventing the growth of weeds. On the salted area without any hoeing but few weeds appeared, and those late in the season. On the unsalted area weeds appeared in abundance as the season advanced.

The author believes that while the beneficial action of the salt may be attributed in part to its effect in preventing weeds, in the sandy soil, upon which the experiment was conducted, there was an effect and beneficial action beyond this. While in modern methods of field culture salt may not be especially useful, it is believed that for the small garden patch where intensive culture is practiced it may answer a very useful purpose, especially in keeping down weeds.

The author has used asparagus along division and back fences, where it serves the double purpose of ornament and use. In such locations he has also found salt beneficial.

Onions and bunch crops at Beeville, J. K. ROBERTSON and E. C. GREEN (*Texas Sta. Bul. 77, pp. 28, figs. 14*).—Experiments are reported on the culture of onions with and without irrigation, and of beets, radishes, lettuce, carrots, and turnips for bunching for the early market. With each crop tests of varieties were also made. The growing of early garden crops for northern markets is rapidly developing in south Texas.

Onions (pp. 4–14).—With this crop the seed was sown in beds and the onions transplanted to the field when they had attained suitable size. Thrips, which seriously affected the onions in the seed bed, were kept under control by spraying with whale-oil soap used at the rate of 2 lbs. dissolved in 6 gal. of water. At setting out time the tops of the onions were trimmed to about 5 in. and the roots cut back to about 0.75 in. Eight cultivations were given. In addition the unirrigated plat received one hoeing.

Level cultivation was practiced and at no time was it deeper than 1.5 in. The irrigated plat received 4 irrigations in addition to the preparatory one which was given to both irrigated and unirrigated plats alike. A mixed fertilizer containing 5 per cent nitrogen, 6 per cent phosphoric acid, and 9 per cent potash was applied at the rate of 500 lbs. per acre and worked in each side of the row in March.

On one-twentieth of an acre the irrigated plat yielded 1,928 lbs., of which only 2 lbs. were unmarketable. The unirrigated plat of the same area yielded 987.4 lbs., of which 12 lbs. was unmarketable. These yields are at the rate of 676.5 bu. and 350

bu. on the irrigated and unirrigated areas, respectively. The onions sold at Beeville for 2 cts. a pound. The net profits from one-twentieth of an acre with irrigation was $33.45 and from the unirrigated plat $15.69. All of the expenses, such as cost of preparing land, irrigating, transplanting, cultivating fertilizing, harvesting, sacking, seed, etc., are shown in tabular form. The variety used was the Red Bermuda.

It is believed that the results secured in these tests with irrigation would have been greater had the irrigating facilities been more efficient. At times the onions suffered from lack of moisture. In the variety tests 19 varieties were compared. The Bermuda again proved superior in point of earliness and yield. Brief descriptions are given of the different varieties tested.

Beets (pp. 15–20).—The beet is the favorite bunch crop of south Texas truckers. The crop requires from 80 to 90 days to reach marketable size from the time the seed is sown. With good culture two crops can be grown between October and May.

In the station experiment bat guano was used broadcast at the rate of 500 lbs. per acre when the land was prepared. Six irrigations and 9 cultivations were given. Frost and ice occurred 12 times during the months of January and February, but the freezes were not sufficiently severe to seriously injure the crop, though they did retard growth. The bunches were shipped in ventilated barrels without ice. From 19 to 25 doz. bunches were packed in each barrel, the tops toward the center. Details are given as to the cost of each of the different operations in the growing of the crop and the length of time employed.

The crop was marketed in Kansas City and St. Joseph, Mo. In March and April they brought 40 cts. per dozen bunches and in May 25 cts. The net returns from the sale of beets grown on one-tenth of an acre was $67.51 and the cost of production $13.28, leaving a profit of $54.23. The authors state that a net profit of $500 per acre for a single crop of beets is within the range of possibility in that section.

Variety tests indicated that the Electric variety can be most safely recommended. Crimson Globe and New Meteor of the newer varieties are considered especially promising. Details as regards date of planting, period of growth, productivity, etc., are given for 12 varieties grown in the test and these varieties are briefly described.

Radishes (pp. 20–25).—Three profitable crops of radishes can be grown during the fall and winter seasons in the vicinity of the station. From one-tenth of an acre 169 doz. bunches were sold, each bunch containing from 12 to 16 radishes. The cost of growing one-tenth of an acre of radishes was $5.60. The radishes sold for $39.27, leaving a net profit of $33.67. Exclusive of the radishes sold, about 1.5 bbls. were destroyed by a severe frost on the night of January 25.

In shipping radishes they are packed in unventilated barrels in concentric circles with the tops toward the center of the barrel. When the barrel is about one-third full of radishes a layer of crushed ice is put in. A second layer of ice is added when the barrel is two-thirds full of radishes, and the final layer when the barrel is nearly full. The ice is broken up so that none of the lumps is larger than a hen's egg. About 50 lbs. of ice is used per barrel. Enough radishes are heaped on the top layer of ice so that when the barrel arrives at its destination it is about level full with the radishes.

Twenty-eight varieties were grown in the variety test. The turnip-rooted varieties are considered the most desirable for the western markets. Of these Scarlet White Tipped is the most popular on account of its attractive appearance. The test indicated that Round Scarlet Chinese and Icicle are worthy of trial for the kitchen garden, as they were of the best table quality. All of the long-rooted varieties except Market Gardener Long Scarlet, Chartier, and Early Short Top Long Scarlet became pithy or hard and woody before reaching a suitable market size, the last two mentioned being recommended when a long-rooted sort is wanted.

Lettuce, carrots, and turnips (pp. 26–28).—The cultural tests with these crops failed, but the results secured in tests of 21 varieties of lettuce are recorded with brief

descriptions of the varieties tested. All the varieties of lettuce suffered from lack of water and insufficient fertility and none of the plain-leaved varieties headed up satisfactorily. "The crinkled and loose sorts made the best heads and were slower to run to seed." Rice birds destroyed the carrot crop. Of the 16 varieties of turnips tested the Purple Top White Globe and the White Dutch Strap Leaf are recommended to truckers as of market value. The Purple Top Flat Strap Leaf and Extra Early White Milan are also considered satisfactory.

Rhubarb in Arkansas, E. Walker (*Arkansas Sta. Bul. 86, pp. 47–52*).—Rhubarb has been grown at the station for the past 4 years with excellent results. It does not thrive in the warmer parts of the State, but has been grown successfully at elevations of 1,500 ft. It is believed that it can be successfully grown over a large part of northern Arkansas where suitable soils can be found. Popular directions are given for growing the crop out of doors and for forcing.

Pruning; wounds and their treatment; pruning tools, H. H. Hume (*Bul. N. C. Bd. Agr., 26 (1905), No. 1, pp. 31, figs. 30*).—Right and wrong methods of cutting off limbs in pruning are described and illustrated, and a discussion given of when to prune and how to treat the wounds made in pruning. Illustrations and descriptions are also given of pruning tools, with estimates as to cost and directions for their use.

Nitrate of soda as a fertilizer for fruit trees, B. Trenkner (*Gartenwelt, 9 (1905), No. 27, pp. 313–316, figs. 4*) —An account is given of the increased yield of cherries and apples secured when nitrate of soda was used as a fertilizer.

Illustrations are given which show graphically the difference in yield when this fertilizer was employed and when it was omitted. The author has applied as much as 500 lbs. per acre without injurious results Injury to fruit trees through overfertilizing with nitrate of soda first shows itself in the youngest shoots, which turn brown, wrinkle up, and look as though they were burned.

As a result of 10 years' experience in the use of this fertilizer in connection with potash and phosphoric acid fertilizers the author holds that not only is the nitrate beneficial and profitable, but for those who would secure the greatest returns it is indispensable.

A straw mulch in the orchard, U. T. Cox and W. J. Green (*W. Va. Farm Rev, 13 (1905), No. 4, p. 18; reprinted from Stockman and Farmer*).—An account is given of mulching 250 apples trees with straw.

Eight tons of straw costing at the rate of $9.50 per ton were used. About 25 trees were left unmulched for comparison. The fall season was very dry, there being but very little rain from the middle of August until December. The mulched fruit was increased considerably in size and the percentage of first-grade fruit increased about 14 per cent by the use of the straw. As a result of the better appearance and higher grade of the mulched fruit, it is estimated that it would bring 25 cts. more per barrel than the unmulched fruit.

"The color was much better where mulched, as the dry weather caused the leaves to fall from the unmulched trees before the fruit fully matured in some cases. The gain in number of barrels and increased size of fruit was about $135, and if that extra 25 cts. per barrel be added would make it $235 gain, and probably half the value of the mulch remains for future crops. . . .

"Some of the fruit from the unmulched trees looked dead, felt spongy, and was tough, while that from the mulched trees was bright, crisp, and solid. The mulched trees seem to be in condition to bear next year and the others are not likely to bear for 2 years. The drops are clean and not bruised where there is a good mulch, will keep, and are worth more than those from rocky bare ground. The variety was nearly all Rome Beauty in the tests, and all that were counted were of that variety."

Plums in South Dakota, N. E. Hansen (*South Dakota Sta. Bul. 93, pp. 88, pls. 16, fig. 1*).—An account of plums and plum growing in South Dakota.

Plums of large size and good quality can be raised in abundance in all the farming regions of South Dakota and in the grazing regions wherever irrigation can be had. The only varieties which succeed, however, are native kinds. Of the hundreds of varieties which have been brought from Europe, Japan, China, Persia, other parts of Asia, and from the Gulf and Atlantic regions of the United States all have proved unsuitable owing to the vicissitudes of the climate. The varieties which succeed best are those which have been developed from the native sorts which grow in the region from Iowa and Nebraska northward through Minnesota, Wisconsin, the Dakotas, Manitoba, and Assiniboia.

Historical notes and brief descriptions are given of 83 named varieties of plums and of a number of seedlings. The fruit of many of these varieties is illustrated. A discussion is given of different sorts of stocks for plums and plum propagation, cultivation, marketing, and breeding, with notes on the culinary uses of plums.

Keeping apples, J. C. M. JOHNSTON (*Country Gent., 70 (1905), No. 2732, p. 538*).—To keep apples successfully over winter the author states that the storage room should be cold to prevent rot, damp to prevent wilting, and dark to prevent ripening. Cellars which have water on the floor from September to June are considered best for apples. In the fall the cellar windows should be left open on cool nights and not closed permanently until there is danger from freezing. A cellar temperature of about 30° F. is advocated.

Small fruits in 1903, J. P. PILLSBURY (*Pennsylvania Sta. Rpt. 1904, pp. 253–262*).—This work with small fruits is in continuation of that previously reported (E. S. R., 16, p. 773) and deals with the yields of strawberries, gooseberries, and currants at the station.

The wide-matted row and hill systems of strawberry culture which have previously been observed at the station have been changed to the narrow-matted row with better results. The berries in the narrow-matted row are of a more uniform size and the percentage of small ones is decreased. The principal factor influencing the crop of strawberries is the amount of rainfall in May and June, especially in the former month. A lack of rain, however, can be partially overcome by the use of a mulch and thorough cultivation.

By these methods at the station berries were secured in spite of dry weather long after local dealers were able to obtain fruit from other sources in the neighborhood. A table is given showing the sex, fruiting season, freedom from disease, vigor, yield, etc., of a large number of varieties.

The ferment of the tea leaf, III, H. A. MANN (*Indian Tea Assoc. [Pamphlet 2], 1904, pp. 12*).—In the present report experiments conducted on a practical scale are cited which confirm the results given in the two former reports (E. S. R., 15, p. 451) relative to the dependence of the fermentation upon an enzym, and the relation of the quantity of this enzym to the quality of the tea.

Data are given showing more exactly the time required for the best results in withering when the temperature is high, low, and medium, and when the atmosphere is dry or wet. Relative to the latter the table below is given, which shows the maximum time required for the greatest development of enzym in the withering leaves at different temperatures under normal conditions and in a saturated atmosphere:

Maximum time required for the greatest development of enzym in tea during withering.

Temperature range.	Time required under normal withering conditions.	Time required with saturated atmosphere.
78–84° F.	Not exceeding 22 hours	Not exceeding 25 hours.
78–88° F.	Not exceeding 18 hours	
80–90° F.	Not exceeding 16–18 hours	Not exceeding 18–21 hours.
84–92° F.	Not exceeding 14.5–16.5 hours	Not exceeding 18.5 hours.

The figures in the table were obtained with Assam leaf. "Given normal withering conditions, the leaf should be so spread as to be physically ready for rolling in approximately the times indicated in the first column above. If, on the other hand, the atmosphere is so saturated that withering does not take its usual course, the chemical condition of the leaf will begin to deteriorate after approximately the times given in the second column of the above table. Whether the manufacturer will find it of advantage to leave his leaf longer than this before manufacture, in the hope of getting leaf in better condition for rolling, is a matter for him to settle, but if he does so leave it it is at the cost of losing some of the quality of the tea produced."

Some attention has been paid to the changes other than that of the enzym in tea during withering, and it has been shown that the total soluble constituents of the tea leaf are considerably increased by withering. Attention is called to the desirability of sterilizing with boiling water the vessels used in handling the leaf, as well as the racks and rollers in the factory, if the best quality of tea is to be produced.

Earlier experiments seemed to indicate that the enzym of tea was not destroyed during fermentation by the presence of salicylic acid, but further work indicates that "its use always brings about a thinner liquoring tea than otherwise, and this has now been explained by the discovery that the ferment was slowly destroyed by its action. Twenty hours, as a matter of fact, after the addition of salicylic acid to a strong solution of the tea ferment, all the latter had disappeared."

Growing chrysanthemums for a retail trade, F. CANNING (*Massachusetts Sta. Rpt. 1904, pp. 168–172*).—Directions are given, based on the work in the college greenhouse, for growing chrysanthemums for a retail trade.

The culture of chrysanthemums is discussed and the varieties most suited for this purpose are mentioned and described. Methods of using the score card in connection with the judging of chrysanthemums are included. As to the merits of solid beds or benches the author's experience is in favor of solid beds. The soil used for benches and pot plants is a good turfy loam composted the previous fall or in the early spring of the same year. To 3 parts of this soil is added 1 part of well-rotted manure and about a quart of bone meal to each barrowful of compost.

FORESTRY.

Trees, a handbook of forest botany, H. MARSHALL WARD (*Cambridge: Univ. Press; New York: The Macmillan Co., 1904, vol. 1, pp. XIV + 271, figs. 137; vol. 2, pp. X + 348, figs. 125; 1905, vol. 3, pp. XII + 402, figs. 143*).—This series of volumes is designed to furnish students of forest botany with a guide to the study of trees and shrubs, and will be found useful to the amateur who wishes to know something of the trees and shrubs about him, and to the technical student as well. The language is not unnecessarily technical, and the books will serve as an introduction to the more modern methods of systematic botany and morphology. The author seeks to encourage first-hand acquaintance with trees in their natural surroundings, which requires a knowledge not only of the characters usually employed by systematists but also of buds, twigs, leaves, seeds, seedlings, etc., which are commonly disregarded in all but special treatises on the subjects.

The volumes already issued bear the titles Buds, Leaves, and Flowers and Inflorescences, and the succeeding volumes will treat of Fruits and Seeds, Seedlings, and Habit and Conformation of Trees. At the end of each volume keys will be given for use in the field, each series being based upon the characters treated in the volume.

Forest preservation and national prosperity (*U. S. Dept. Agr., Forest Serv. Circ. 35, pp. 31*).—This circular contains portions of addresses delivered at the American Forest Congress, held in Washington, January 2–6, 1905, by President Roosevelt, Ambassador Jusserand, Secretary of Agriculture Wilson, and others.

European study for foresters, T. S. WOOLSEY, Jr. (*Forestry and Irrig.*, *11* (*1905*), *No. 6*, *pp. 160–163*).—The desirability and advantages of a few months' study and observation in the forestry schools and state forests of Germany, France, and India are discussed.

The forest flora of New South Wales, J. H. MAIDEN (*Sydney: Govt.*, *1905*, *pt. 16*, *pp. 125–140*, *pls. 4*, *fig. 1*).—Botanical descriptions, with the local names, and an account of the propagation and timber uses of the weeping myall (*Acacia pendula*), *Eucalyptus amygdalina*, forest oak (*Casuarina torulosa*), and the ivory wood (*Siphonodon australe*).

Timber resources of Liberia, E. LYON (*Mo. Consular Rpts.* [*U. S.*], *1905*, *No. 296*, *pp. 135–138*).—Attention is called to the opportunities in Liberia for hard-wood lumbering. The principal woods are mahogany, oak, cedar, rosewood, mangrove, burrwood, white and black gum, mulberry, brimstone wood, red peach, pepper wood, persimmon, iron wood, greasy peach, poplar, cherry, hickory, saffron, ebony, etc.

It appears that there are no efficient sawmills now operating in Liberia, and that most of the imported lumber is not adapted to the climatic conditions or to resist the attacks of destructive insects, which devour an ordinary house built out of foreign pine in less than a year. Locations suitable for sawmills are pointed out, and estimates given as to probable cost of installing.

Planting red pine (*Forestry and Irrig.*, *11* (*1905*), *No. 5*, *pp. 235–238*).—The red or Norway pine (*Pinus resinosa*) is said to be a light-demanding species. It bears less shade than white pine but more than the jack pine.

In a natural seeding on sandy soil the red pine grew 0.97 ft. per year for the first 15 years, while jack pine grew 1.32 ft. For the first 50 years it is stated that the jack pine grows fastest, red pine second, and the white pine last. The white and red pine live from 280 to 310 years, while the jack pine rarely exceeds 90 years.

The red pine is generally propagated from seed which fall from the cones the same year they mature. The seed appears to be borne at intervals of 2 to 4 years. A pound of red pine seed contains about 40,000 seeds, of which about 80 per cent should germinate under favorable conditions. The seed when planted in drills is sown at the rate of $\frac{1}{8}$ to $\frac{1}{28}$ oz. per running foot, or from $\frac{1}{4}$ to $\frac{1}{7}$ oz. per square foot. When seeded broadcast the average number of seedlings per running foot the first year varies from 16 to 22, and the second year from 8 to 10.

Seed is sown early in the spring in about the same manner as white pine, but less shade is required. The best stock to plant is 2-year-old seedlings. On poor soil plants may be spaced 5 ft. apart each way, while on richer soil it is best to make the spaces wider. A number of examples are given showing the growth of red pine in comparison with white pine in different plantations.

An instance is cited in which red pine seeds were accidentally planted with jack pine seed in Nebraska. The following winter all the jack pine seedlings were winter-killed, while some 40 or 50 plants of the red pine came through the winter without injury, making a good growth the following summer.

Pitch pine in Pike County, Pennsylvania, J. BENTLEY, Jr. (*Forestry Quart.*, *3* (*1905*), *No. 1*, *pp. 1–17*, *pl. 1*).—This is an account of a study of the life history and growth of the pitch pine near Milford, Pa., by H. S. Graves, assisted by members of the junior class of the Yale Forestry School during the summer of 1904.

This region is 1,000 to 1,400 ft. above the sea. The various factors studied were local distribution, form and development, sylvicultural characteristics, reproduction, and growth in volume, diameter, etc. The 2 prominent characteristics which largely determine its distribution are (1) its extreme intolerance of shade and (2) its ability to withstand adverse conditions, such as poor soil, exposure to wind, fire, etc. Observations on the height growth for trees 1 to 10 years old showed an average increase

in height of about 6 in. per year. Mature trees grown in the open rarely exceed 50 ft. in height and are irregularly shaped.

Pure stands are comparatively rare. In one instance a pure stand of 18-year-old trees, covering about an acre, ranged in height from 10 to 16 ft. A sample square rod 12 yards distant from the parent tree showed 27 young trees, of which 11 were dominant. In mixtures the pitch pine must be a dominant tree, and remain so if it is to exist. Under such conditions the trees grow from 60 to 70 ft. in height and in some cases 80 ft. The dominant pitch pine found in hard woods is of most economic value.

The pitch pine appears to be most intolerant to shade during the early years of growth. Observations indicate that trees 12 to 25 years of age growing singly require an area whose radius is from 8 to 10 ft. The tree grows on nearly all kinds of soil, but prefers a sandy, loamy, or even a stony soil to the heavy clay soils. It appears to be especially resistant to the attacks of fire due to its unusually heavy bark, which in mature trees is often as much as 1.5 in. thick. It is used sylviculturally as a nurse for white pine. Trees 8 years old bearing cones were observed. These cones, however, were sterile.

The cones on trees 20 to 30 years of age produce some fertile seeds. The seed years appear at intervals of from 3 to 5 years. The cones are very persistent and the seeds frequently ripen and fall from the cone while it is still on the tree. Wind appears to be the most important agent in the distribution of the seed. This pine sends up sprouts from the old stump. Tables of volume and growth are given showing the stem analyses, as regards volume and rate of growth, of 67 pitch pines cut during the summer.

Cultivation of the cinchona tree in Java, R. M. BARTLEMAN (*Mo. Consular Rpts. [U. S.], 1905, No. 296, pp. 159, 160*).—The methods of cinchona tree culture in Java are described.

Zapote tree and chicle gum, A. J. LESPINASSE (*Mo. Consular Rpts. [U. S.], 1905, No. 296, pp. 241-243*).—The wood of the zapote tree is described and an account given of the chicle industry in Mexico.

Continuous tapping of the zapote does not appear to seriously injure the tree providing the incisions are not too deep. Trees have been tapped 25 years, at the end of which time they produced only from 0.5 to 2 lbs. of sap. When allowed to rest 5 or 6 years they produced from 3 to 5 lbs. New trees produce from 15 to 25 lbs. of sap according to size. In order to produce the latter amount a tree would have to square about 2 ft. and be from 25 to 30 ft. high.

Guayule and its economic importance, R. ENDLICH (*Tropenpflanzer, 9 (1905), No. 5, pp. 233-247*).—A description is given of the guayule rubber plant (*Parthenium argentatum*), which grows wild in Mexico and which is being harvested and used commercially for the production of rubber.

The methods of extracting rubber from this plant are briefly described and the possibilities of the industry discussed. At present the dried plants bring from $30 to $40 per ton. Recently methods for manufacturing the rubber from the plant have been so improved that besides the water content of the rubber there is but from 10 to 15 per cent of foreign substance. The dried plants furnish from 8 to 12 per cent of rubber, depending upon the amount of moisture which they contain.

The author figures that a commercial factory which would turn out 1,000 kg. of guayule rubber per day would require from 10,000 to 14,000 kg. of dry raw material. This would require the material from 16 to 24 hectares daily, or from 6,000 to 8,500 hectares during the year. The plant grows very slowly and after it has once been cut off requires about 10 years to again reach suitable size for cutting. These calculations give an idea of the extent of land required to make the growth of this plant profitable commercially.

Some of the advantages are that the plant will grow on very poor and dry land. It grows best in a subtropical climate, which is of advantage from the standpoint of labor, and is not injured by night frosts. The crop can be worked up at any time during the year. In districts suited to its culture it is believed that the crop can be grown profitably, especially if culture and manufacture are combined.

An English translation of this article has recently appeared in *The India Rubber World, 33 (1905), Nos. 4, pp. 335, 336, fig. 1; 5, pp. 367-369.*

Caoutchouc plants; an agricultural-geographical study, P. Reintgen (*Tropenpflanzer, Beihefte, 6 (1905), No. 2-3, pp. IV+73-218, dgms. 4, map 1*).—Part 1 of this treatise deals with the discovery and uses of caoutchouc and part 2 with the individual caoutchouc plants, describing them and giving their habitat, cultural requirements, and economic value in each of the different countries in which they are grown. Statistics are included as to the production and exports of different countries. A bibliography of 65 papers on the same subject is included.

Eucalyptus screens as fire protection belts (*Indian Forester, 31 (1905), No. 5, p. 297*).—A note is given in which it is stated that in Cape Town, South Africa, 6 rows of eucalyptus planted 6 by 6 ft. are placed around plantations, etc., and within 5 or 6 years they form a barrier which no fire can cross, since they kill out all the grass completely and at the same time prevent burning leaves, etc., from being blown across.

A successful root-pruning device now in use at the Government nursery in Nebraska, L. C. Miller (*Forestry and Irrig., 11 (1905), No. 6, pp. 168-170, figs. 3*).—From observations in the Bureau of Forestry Nursery at Halsey, Nebr., where two and a half to three million seedlings are grown annually, it has been found that the seedlings should be 2 years old before planting to their permanent sites.

To transplant these seedlings at the end of the first year greatly increases the cost of production. As a substitute for transplanting, the seedlings are root pruned. The author devised a tool for this purpose by which 2 men working 8 hours can prune from 100,000 to 150,000 seedlings. "The important feature of this tool is the cutting blade. This is 1 in. wide and one-eighth of an inch thick, and made from a first-class piece of steel. It is U shaped, and the perpendicular sides are 7 in. long and the horizontal base is 6 in. long.

"This blade is riveted to substantial collars, which are made to fit on a Planet, Jr., garden hoe frame. This is a single-wheel frame, and in order to have the wheel run between the rows of trees it was necessary to change it to the outer side. . . . The cutting blade is filed to a keen edge and kept so during the pruning operation. By having such a thin blade and keeping it sharp, there is practically no resistance offered in passing through the soil, and all roots are cut without the usual injury done with a heavier tool." Two men are required to operate the tool satisfactorily, one to pull it through the soil and the other to guide it.

The movement of wood prices and its influence on forest treatment, B. E. Fernow (*Forestry Quart., 3 (1905), No. 1, pp. 18-31, dgms. 2*).—A paper read before the American Association for the Advancement of Science at its December meeting, 1904.

Statistics largely from German, Austrian, and Swiss sources are drawn upon to show that there has been a steady advance in wood prices during recent years. The distinction is made between wood prices and lumber prices, for while various factors, such as improvement in machinery for sawing timber and handling lumber, may tend to keep down the price of lumber, the stumpage prices of wood are steadily increasing. In Prussia wood prices have doubled within the past 50 years.

In America stumpage prices appear to be rising relatively faster than lumber prices. Stumpage of pine is now held at \$2 to \$3 per 1,000 which 10 years ago could be bought for 50 cts. to \$1. The average stumpage price in Europe for work wood is placed at 6 cts. per cubic foot, or about \$10 per 1,000.

DISEASES OF PLANTS.

Report of the botanist, G. E. Stone and N. F. Monahan (*Massachusetts Sta. Rpt. 1904, pp. 7–34, dgms. 2*).—A report is given of the investigations carried on by the botanist and his assistant, most of the work being conducted in the greenhouses in connection with the cultivation and diseases of roses, carnations, violets, tomatoes, and melons.

Brief reports are given on field investigations, and it is stated that asparagus rust was more prevalent than during the previous year. Considerable damage is reported to cultivated dandelions by stem rot, and the cucumber and melon blight, which have been previously quite troublesome, during the season reported upon were hardly observed at all. The worst injuries reported were due to winterkilling and the effect, as shown upon various shrubs and trees, is described.

In continuation of previous work, the authors have carried on experiments in soil sterilization, and in the present report a résumé is given of the results obtained from this practice. Sterilization has proven a satisfactory means for lessening the amount of infection in lettuce houses where the plants were affected with drop and Rhizoctonia, and also as a means of ridding them of nematodes. It was found that sterilization of the soil modifies the texture of lettuce, having a decidedly stimulating effect.

In connection with the stimulated growth, plants are somewhat more subject to disease and on this account greater attention must be given the ventilation and temperature of the houses. It is believed by proper ventilation and watering that the Botrytis rot of lettuce can be eliminated to a great degree. With cucumbers, sterilization of the soil was found to force the plants to a considerable extent, especially when under favorable conditions regarding light.

Where the conditions of growth are abnormal the sterilization was without any value in stimulating growth. A decidedly beneficial effect on the growing of carnations was shown where sterilized soil was used, the amount of disease being greatly reduced. No detrimental influence on the soil itself has been observed in the extensive series of experiments which have been carried on at this station.

In continuation of previous investigations (E. S. R. 16, p. 335), a report is given on the influence of electrical potential on the growth of plants. Comparisons were made of the growth of roots and tops of radishes when electrified and when not subjected to such treatment, which show that the leaves of the electrically treated plants were quite different from those of the normal ones. The electrical stimulation seems to give rise to conditions similar to those caused by lack of light which results in a partial etiolation.

Comparisons are reported of the atmospheric electrical potential in trees and in the free air, which show that some trees have a greater tendency toward conducting the electricity from the air to the earth and others have a tendency for conducting the electricity from the earth to the air. In all probability the exchange of electricity from the earth to the air or vice versa does not take place at the same time from the same tree. It is probable that some trees always conduct electricity from the air to the earth, while others conduct electricity from the earth to the air; and it is also probable that in the vicinity of large trees there may be a detrimental influence to crops and vegetation in general which can not be accounted for by lack of sunshine or soil moisture.

References are given to the more important literature relating to diseases of crops which are believed not to be caused by fungi or insects. This is supplemental to the previous publications of the Connecticut State Station (E. S. R., 5, p. 1078; 13, p. 154). The list is intended to supplement those previously mentioned and to give the more important publications of the experiment stations and the United States Department

of Agriculture relating to a number of functional and unknown disorders of cultivated plants.

Report of the botanist, H. L. BOLLEY (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 33–56, pls. 7*).—In studying the cause of the wheat blight, which results in the so-called "white heads," or unfilled heads of a white color, the author has been unable to isolate a definite organism causing the disease, but he believes that the trouble is due to a fungus which is transmitted by way of the soil, in a somewhat similar manner to that causing the wilt of flax. The disease seems to be more general in poorly drained areas and in fields in which wheat has been continuously cropped, and for the present the author recommends draining of the heavy areas and rotation of crops as means for preventing this disease.

Considerable attention has been given to the cause of "starchy," spotted grains in hard wheats, the trouble being locally known as "white belly." Grains of this character are generally graded as soft wheats, and are believed to be inferior to the hard wheats of the Northwest. A number of experiments were carried on in which germination trials, microscopical tests, and cross-fertilization trials were made, and also the effect studied of exposure of harvested bundles to the ordinary weather conditions.

From the results the author believes that the white spots are not due to crossing, nor are they matters of heredity, but that this peculiar mottling is due to the action of moisture, air, and sun upon the grain while it is yet in the chaff. If the weathering action is long continued, the grains become evenly bleached over their entire surface. The color and hardness of the grain can be maintained by proper care in harvesting and curing.

Experiments to determine whether an efficient dry process of treating wheat for the prevention of smut could be discovered indicated that while this might be possible the methods tested were not as efficient as the use of formaldehyde, etc., and required quite as much care in their application. The claims for Ozonet powder as a smut preventive were not found to be justified.

In tests of the effect of evaporation upon solutions of formaldehyde, covering periods of from 1 to 15 days, it was found that the solutions, instead of becoming weaker on standing, became more concentrated. Hence, solutions which have stood open for a number of days may be depended upon as being fully as strong as when first made. Experiments on the effect of different types of water on formaldehyde treatment showed little or no influence.

Regarding the popular belief that smutted wheat may be safely used for seed after it has been stored for a period of years, tests of the influence of age upon the germination of smut spores showed that they do not lose their vitality under ordinary methods of keeping for a period of at least 7 years. An account is given of investigations on the breeding of wheat for resistance to smut and rust, with a general discussion of the effect of rust on the wheat crop. The author suggests that seed may be used from rusted crops providing it is thoroughly screened, and where this practice is carried out the effect of breeding will be secured to some extent.

Notes are given on the germination of light-weight wheat from a rusted crop, and also germination tests of frosted grains. From a microscopical examination of frosted grains the author states that apparently the injury is confined to the outer bran layer, and that there is no apparent change in the inner layer or contents of the grain. Whether the quality of the grain for producing flour is injured would be determined only by a chemical and manufacturing test.

For more than 12 years the author has been carrying on experiments on potato scab, and during these studies he has often noticed what appeared to be a tendency to immunity on the part of certain individuals or strains. From 1893 to 1900 some selective work was carried on with the Early Ohio potato, and the results obtained show that it is possible to increase resistance to disease to a considerable extent.

Through all these experiments it was found that while the methods of culture remained the same, the yield per hill became greater each year and the tendency to disease was less apparent. The work with potatoes is being continued, and the author has undertaken to secure immunity through the breeding of resistant strains where the conditions supposed to favor disease are artificially produced and persistently maintained.

A brief account is given of experiments on internal tree feeding and medication, which the author states will be fully described in a future publication. It is stated that sufficient facts have been obtained to warrant the belief that valuable individual trees may be saved from the action of certain diseases by this method, but more extensive experiments will be necessary before the work will be adapted to ordinary horticultural practice.

Report of the botanists, L. R. JONES and W. J. MORSE (*Vermont Sta. Rpt. 1904, pp. 383–402*).—After reviewing the occurrence of plant diseases during 1904, commenting briefly on potato blight, arsenical poisoning of potatoes, various diseases of orchard and small fruits, etc., the authors give the results of spraying experiments in 1904, discuss the relation of the date of digging to the development of rot and the value of liming for the prevention of potato rot, and describe experiments with formaldehyde gas for the disinfection of scabby potatoes

The results of the spraying experiments in 1904 are described at considerable length. This season's work constitutes the fourteenth year in which records have been kept on the use of Bordeaux mixture for spraying potatoes. In 1904 the results obtained, as indicated by the total yield, were not as pronounced as usual, which is attributed to the very late appearance of blight. The early potatoes were practically all out of the way, and in most cases the later varieties had nearly matured before the disease made its appearance. It is believed that owing to the unusual conditions much of the spraying done in Vermont during 1904 was performed at actual loss, but the average results obtained for the 14 years would indicate that the use of Bordeaux mixture, when properly applied, is economically advantageous for the prevention of potato blight.

In continuation of previous work (E. S. R., 15, p. 1088) the authors have investigated the relation of the date of digging to the development of rot, and as a result of 3 successive seasons' work they recommend the following as a safe rule for Vermont farm practice:

"When potato tops have been killed by the late blight fungus and there is consequent danger of rot of the tubers, do not dig them until a week or more after the tops were killed. A longer delay will do no harm. With late varieties, where the progress of the disease is slow, do not begin digging until the third week of September at the earliest, and if practicable wait until after the tops are killed by frost."

As a result of two years' trials the authors doubt the practical value of lime as a preventive of rot.

A description is given of the disinfection of scabby potatoes by formaldehyde gas. The authors have devised a method for the treatment of seed potatoes in large quantity in storage bins, the value of which is shown. A portion of formaldehyde was added to water, and the solution distilled into an air-tight compartment containing the potatoes, after which the potatoes were allowed to remain in the fumigation chamber for 24 hours or longer. This method of treatment has given highly satisfactory results.

New work upon wheat rust, H. L. BOLLEY (*Science, n. ser., 22 (1905), No. 550, pp. 50, 51*).—The author reports a definite establishment of the fact that the uredospores of *Puccinia graminis* are able to pass the winter in a viable form.

Experiments carefully controlled seem to indicate that these spores may remain unimpaired by the dry winds of autumn and the intense cold of a North Dakota winter. In some instances as high as 90 per cent of all spores examined were capable of

germinating. The spores were found on dead leaves, straw, and on the partially dead or green leaves of living grain or grasses. This also applies to a number of other important rusts which attack wheat and allied grasses.

In the case of *Puccinia rubigo-vera*, it has been found wintering freely on living leaves of wheat or winter rye, and upon the matured leaves and straw of the same, from Mississippi to North Dakota.

Report on the root-rot investigations, Z. KAMERLING (*Verslag van het wortelrot onderzoek. Soerabaya: H. van Ingen, 1903, pp. 209, pls. 5*).—The author reports on the various studies he has made to determine the cause of root rot of sugar cane.

The physical structure of the soil has been found to be one important cause, and physically poor soils are defined as those on which the cane develops poorly or dies prematurely. Such soils have a very close structure, the grains of less than $\frac{1}{10}$ mm. being all distinct and separate from each other. Better soils are those in which few or many of these small grains adhere in masses, forming a more open structure. In the latter case the soil particles may be stuck together either by humates, by iron hydroxids, or by iron silicates. The structure of the soil may be improved by the addition of river silt, by cultivation, and by irrigation.

Soils which are in poor physical condition become closely packed, so that they are poorly aerated and hard, making it difficult for the cane roots to penetrate. This condition causes malformation of roots as well as stunted growth. Measurements of cane roots made from plants growing in especially prepared soils showed that the volume of soil penetrated by roots growing in soil of good physical structure was eighteen times as great as the volume of soil penetrated by cane roots growing in soil of poor physical structure.

A number of tests were also made on the relative permeability of soils to water, and it was found that the soils in which the root rot occurred were much less permeable than other soils. The details of the results of these experiments are illustrated by several diagrams.

Poor physical structure of the soil is partly due to loss of humus, which loss, the writer finds, amounts in 3 years to 0.09 per cent for the upper foot of soil. This loss can be made up by adding organic fertilizers in the shape of stable manure with which rice straw, cane leaves, and other organic substances have been composted, or by turning under green plants.

In regard to the presence of root parasites the author expresses the opinion that on otherwise healthy plants the presence of parasites is no very serious matter. It is only when, by reason of poor soil conditions, the plants are weak that parasites are able to do much damage.

A nematode, *Heterodera radicicola*, and several kinds of fungi which occur more or less frequently are described.—H. M. PIETERS.

Smut preventives and their effect on the germination of grain, R. W. PEACOCK (*Agr. Gaz. N. S. Wales, 16 (1905), No. 3, pp. 251, 252*).—The author tested the effect of solutions of copper sulphate and formalin in various strengths, and the hot-water method of seed treatment, for the prevention of smut to determine the possible effect on germination.

In dry districts the use of copper sulphate in solutions of ordinary strength was attended with a loss of 50 per cent of the grain. Formalin was found to be preferable under unfavorable conditions, and the hot-water treatment was decidedly efficacious but can only be recommended to careful operators on account of the narrow limits within which the temperature must be kept.

Disease-resistant potatoes, W. STUART (*Vermont Sta. Bul. 115, pp. 135-140*).—The author has been engaged for 2 years in studying the varying resistance of varieties of potatoes to disease, particularly the late blight (*Phytophthora infestans*).

Of the varieties tested in 1903 one, which is designated as Rust Proof, proved quite resistant to the disease. In 1904 a more extended list of varieties of potatoes together

with a number of distinct species of Solanum were tested for disease resistance. The relative resistance of the different varieties is given in tabular form, marked differences being shown. Of the established varieties tested Rust Proof, Sutton Discovery, June, Mexican, Mammoth Gem, and Manum No. 3 were the most resistant, their power of resistance being in proportion to the order of enumeration.

Resistance to the rot of the tubers and to scab was also investigated, and attempts are being continued in the development of plants, by hybridization and selection of seedlings, that will be more resistant than those now in use.

Potato rot in New Zealand, C. T. MUSSON (*Agr. Gaz. N. S. Wales, 16 (1905), No. 5, pp. 423–428, fig. 1*).—The author suggests special precautions against the introduction of diseased tubers, and the breeding of new varieties of potatoes which have a greater resistant power.

Spraying the plants with Bordeaux mixture is advised to prevent the disease from spreading, and the red-skinned varieties are said to be less liable to attack. For white-skinned ones deep planting is recommended to minimize the chance of tubers being affected, and it is said that nitrogenous manures render the plants more susceptible to disease, while potash manures assist them in resisting attack.

Diseases of melons and cucumbers during 1903 and 1904, J. L. SHELDON (*West Virginia Sta. Bul. 94, pp. 121–138, pls. 5, fig. 1*).—Brief notes are given on the leaf spot (*Cercospora citrullina*), downy mildew (*Plasmopara cubensis*), leaf mold or blight (*Alternaria brassicæ nigrescens*), and damping off, due to *Fusarium* sp.

The results of the author's investigations on the anthracnose (*Colletotrichum lagenarium*) are given at some length. The author describes cultures of the fungus, the germination of the spores, development of the mycelium, etc., and gives the results of inoculation experiments that were made to determine whether the fungus causing the disease known as anthracnose of the watermelon could produce anthracnose in other plants. Inoculations were made from pure cultures and from watermelon fruits into a number of other plants, and the anthracnose was successfully produced on muskmelons, cucumbers, gourds, and watermelons. Failures are reported in all the attempts to inoculate beans, and doubtful results were obtained with inoculations of squashes and a few other plants.

Experiments were carried on for the prevention and control of anthracnose, in which plats were sprayed with soda Bordeaux, Bordeaux mixture, and ammoniacal copper carbonate. The results of the applications showed considerable difference between the sprayed and unsprayed plats, and, considering the improved quality of the melons and the reduced amount of anthracnose, it appears that spraying with Bordeaux mixture was quite successful in combating the disease. The use of the ammoniacal copper carbonate solution was less beneficial.

Bacteria in relation to plant diseases, E. F. SMITH (*Washington, D. C.: Carnegie Institution of Washington, 1905, vol. 1, pp. XII+285, pls. 31, figs. 146*).—This is the first volume of a proposed monograph of the diseases of plants due to bacteria.

In the completed work the author hopes to present the evidence of the bacterial origin of a large number of plant diseases, many of which have been personally studied by him. This publication is intended as a supplement to the numerous textbooks of bacteriology, and while designed primarily for plant pathologists, it will be found valuable to all students of bacteriology. The literature relating to the bacterial diseases of plants is so scattered that all students will welcome its bringing together into an orderly arrangement by a competent investigator.

In the first volume the methods of work are described in detail. The morphology and physiology of the organisms are discussed at length, after which the economic aspects of bacterial diseases of plants are considered. The author then takes up laboratory methods, describing the more approved apparatus, and gives formulas for stains, media, etc. An extensive bibliography to literature is given, the arrangement being chronological by topics.

Apples injured by sulphur fumigation, H. J. EUSTACE (*Science, n. ser., 21 (1905), No. 548, pp. 994, 995*).—A request was recently made upon the New York State Station to diagnose the injury to some apples which had been carefully selected, wrapped in paper, and packed in boxes.

Scattered irregularly over the surface of each apple were conspicuous spots of various sizes where the epidermis was dead, discolored, and slightly sunken. Each spot was nearly circular, and for a few millimeters beneath the spot the flesh was dead, shrunken, and dry as though affected with the dry rot. The center of each of the smaller spots showed small bodies which proved to be the lenticels of the apple. A careful examination failed to show the presence of either fungi or bacteria, and this led to the belief that some treatment of the fruit such as fumigation might be the cause of the injury.

Sulphur being commonly used for fumigation, experiments were conducted with it, and although repeated many times with wet and dry fruit, always produced the same characteristic spots. The presence of a lenticel in the center of each spot would indicate that the sulphur dioxid passes into the center of each spot and causes at least the bleaching of the tissue. Similar effects were produced where artificial breaks were made in the epidermis. While the author's experiments were confined to sulphur, it is believed that other chemicals would produce a similar injury.

Spraying grapes for black rot in Erie County, Pennsylvania, G. C. BUTZ (*Pennsylvania Sta. Rpt. 1904, pp. 241–252, pls. 2, dgm. 1*).—During the season of 1902 considerable loss was caused by black rot of grapes in Erie County, Pa., and for the summer of 1903 the author planned a series of spraying experiments for its control.

The spraying experiments were carried on under the author's direction upon a number of vineyards. The fungicide used was the 4–4–50 Bordeaux solution, applications being made in one instance on May 26 and June 29. In this vineyard the net gain attributed to the spraying is $51.12 on 39 rows of grapes of 55 vines each. In the second experiment 5 sprayings were given the vines, the first 3 consisting of Bordeaux mixture and the last 2 of ammoniacal copper carbonate solution, and the owner of the vineyard estimated a net gain of $24 per acre. In the other experiments similar results were obtained.

The powdery mildews of Washington, W. H. LAWRENCE (*Washington Sta. Bul. 70, pp. 16, figs. 22*).—The results of an investigation on the occurrence and distribution of the powdery mildews are given. Notes are given on the life history of the mildews, methods for combating them, and on a number of the more common diseases caused by them. Keys are presented for the recognition of the different genera and species and technical descriptions given of each species.

The powdery mildew, O. BUTLER (*Bul. Cal. Vit. Club, 1905, No. 1, pp 1–6*).—A description is given of the powdery mildew of grapes and suggestions for its control, based upon compiled information.

The author suggests sulphuring the vines as soon as the mildew appears, and repeating the treatment every time an attack of the mildew appears. Thoroughness of application is essential for proper treatment. The varied susceptibility of a number of varieties is pointed out, and most of the American vines are said to be practically immune, while some of the European species are very sensitive to the fungus attack.

Concerning the identity of the fungi causing an anthracnose of the sweet pea and the bitter rot of the apple, J. L. SHELDON (*Science, n. ser., 22 (1905), No. 550, pp. 51, 52*).—The author reports having examined some sweet pea plants that were affected with some species of Glœosporium. The manner of growth of the mycelium and the way the conidia were produced suggested relationship with the characteristic bitter-rot fungus of the apple and the fungus causing the mummy disease of the guava.

Inoculation experiments were carried on between the sweet peas and apple, producing the characteristic appearance of the bitter rot. An examination showed that

the sweet peas in question had been grown near infected apple trees, and further inoculation experiments showed that seedling peas inoculated with bitter-rot spores and the ripe rot of the grape were killed in a similar way to that described on the original pea stems. It seems probable from the results obtained that the bitter rot of the apple, the ripe rot of the grape, and the anthracnose of the sweet pea are caused by the same fungus.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Kansas mammals in their relation to agriculture, D. E. LANTZ (*Kansas Sta. Bul. 129, pp. 331–404, pl. 1, fig. 1*).—An annotated list is presented of the mammals known to occur in Kansas. All species of economic importance are discussed in a detailed manner with special reference to their distribution, prevalence, food habits, and means of eradicating the harmful species.

In this general discussion, which occupies the major part of the bulletin, attention is given to the opossum, elk, deer, antelope, squirrels, spermophiles, prairie dogs, woodchuck, rats, mice, pocket gophers, rabbits, wild species of the cat and dog tribes, weasels, skunks, moles, bats, etc. Suitable destructive remedies are suggested in connection with each injurious species and a special section is devoted to the methods of applying poisons and other devices in killing harmful mammals.

Proceedings of the seventeenth annual meeting of the Association of Economic Entomologists (*U. S. Dept. Agr., Bur. Ent. Bul. 52, pp. 123, figs. 7*).—An account of this meeting held in Philadelphia, Pa., December 29 and 30, 1904, has been previously given (E. S. R., 16, p. 623). In addition to the papers there noted the following are included in the proceedings:

Preliminary report upon work against a destructive leaf hopper (*Empoasca mali*), F. L. Washburn (pp. 43–47).—Previously noted from another source (E. S. R., 16, p. 889).

Notes for the year, E. P. Felt (pp. 51, 52).—A brief account is given of violet sawfly, San José scale, buffalo tree hopper, Chinese lady beetle, and grapevine root worm. Spraying with arsenate of lead reduced the last-named pest about 50 per cent.

Distribution and migrations of the Mormon cricket (*Anabrus simplex*) *in Colorado*, S. A. Johnson (pp. 62–66).—A fuller account is given in Colorado Station Bulletin 101, to be abstracted later.

The present status of the predatory insects introduced into New Jersey, J. B. Smith (pp. 74–78).—Native species of predaceous insects (*Chilocorus bivulnerus* and *Scymnus marginicollis*) were quite effective. The author's first attempt to introduce the Chinese ladybird failed and specimens of the same insect received from this Department also died. A colony introduced from Georgia is now under test. *Paratenodera sinensis*, a Chinese mantid, was introduced but the results are not promising.

Report on the New Orleans ant (*Iridomyrmex humilis*), E. S. G. Titus (pp. 79–84).—This ant has been known in New Orleans since 1895 and is rapidly increasing in numbers. It nests on the ground or, in wet weather, in trees. The pest assists in distributing various plant lice, scale insects, and mealy bugs. The ant is very destructive to food products of all kinds and flowers. The best means of repelling them is found in the use of corrosive sublimate tape or cloths saturated with kerosene.

Report of the entomologists, C. H. and H. T. FERNALD (*Massachusetts Sta. Rpt. 1904, pp. 111–114*).—The college orchard has been nearly freed from San José scale. Several proprietary insecticides were tested, but found to be of little value. Codling moth is controlled by spraying during the egg-laying season of the pest. Brief notes are also given on various other insects, including white fly, red spider, brown-tail moth, gypsy moth, etc.

Report of entomologist, G. W. HERRICK (*Mississippi Sta. Rpt. 1904, pp. 27–34*).—Several remedies for peach-tree borer were tried. Gas tar did not injure the trees

when applied to the trunk. The life history of the bean-leaf beetle was studied, and arsenate of lead tested without very promising results. Notes are also presented on Southern corn root worm, *Ligyrus rugiceps*, bollworm, an undescribed snout beetle, false chinch bug, San José scale, mosquitoes, *Pegomyia fusiceps*, and *Dynastes tityrus*.

Second annual report of the State entomologist, R. A. COOLEY (*Montana Sta. Bul. 55, pp. 125-180, pls. 3, figs. 25*).—*Phenacoccus dearnessi* was found on apple trees and closely resembling woolly aphis. It occurs also on the elm and may be controlled with soap or kerosene washes.

Otiorhynchus ovatus greatly injured strawberry plants near Missoula. The nature of the attack is discussed and the insect is described in all its stages. Dipping the plants in arsenate of lead was found to render the plants immune for about 2 weeks. The best remedy is probably to be sought in a proper rotation of crops. Remedies for the bud moth were studied by B. J. Jones, who found that the larvæ feed entirely on the leaves after the first spring attack on the opening buds. Trees should be sprayed with arsenate of lead before the buds open and later as required.

Brief statements are also made regarding other insect pests, such as peach-tree borer, apple-tree borers, bronze apple-tree beetle, apple-twig borer, fruit-tree bark-beetle, peach-twig borer, San José scale, woolly aphis, various scale insects, codling moth, plum curculio, etc.

Report of the government entomologist for the half year ended June 30, 1904, C. P. LOUNSBURY (*Cape Good Hope Dept. Agr., Rpt. Govt. Ent. 1904, pp. 35, pl. 1*).—This report contains an account of the routine work of the entomologist, publications, plant import regulations, nursery legislation, ticks, African coast fever, heartwater, and locusts.

It was found that when the brown tick feeds on affected cattle only during the nymphal stage it does not carry infection. The nymphal bont tick carries heartwater, as demonstrated in experiments with goats. Cattle were shown to be susceptible to the disease. Horses are immune. *Rhipicephalus decoloratus* is not pathogenic. Persian sheep are highly susceptible to heartwater, but have very light attacks and are thereafter perfectly immune.

C. W. Mally also presents a report on insects affecting corn and fruit, especially on *Sesamia fusca* and *Ceratitis capitata*.

Annual report for 1904 of the zoologist, C. WARBURTON (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 273-287, figs. 4*).—During the year under report peas were greatly injured by *Diplosis pisi* and *Grapholitha pisana*. When peas are infested with these pests it is desirable that sound pods be removed at once and that infested plants be destroyed.

The adoption of a suitable system of rotation will largely control the insects. Notes are also given on phylloxera and other plant lice, with an account of their biological relations, and special notes on corn aphis, pea aphis, hop aphis, etc. A number of mites proved injurious during the year under report, and ferns were considerably damaged by a new species of mite described under the name *Tarsonemus chironiæ*.

The Hessian fly (*Bd. Agr. and Fisheries [London], Leaflet 125, pp. 3, figs. 7*).—This pest is described, with notes on its food plants, life history, and means of prevention. It is recommended that infested stubble be burned and a suitable rotation of crops adopted.

Julus impressus in the corn field, F. M. WEBSTER (*Canad. Ent., 37 (1905), No. 5, p. 172*).—The author observed what appeared to be this species infesting unripe ears of corn in Illinois and Minnesota. It may prove, however, that some other species was concerned in the production of the injury.

The wormy apple, A. L. MELANDER (*Washington Sta. Bul. 68, pp. 16, figs. 6*).—A popular account of the habits and life history of the codling moth is given, together with notes on the losses due to this insect. Suggestions are also made regarding

remedies. The cost and economy of spraying are discussed. From 90 to 95 per cent of the apples may be saved by proper spraying.

The struggle with the codling moth, W. LOCHHEAD (*Canad. Ent., 37 (1905), No. 6, pp. 197–200*).—The author briefly summarizes the various methods which have been found successful in combating the codling moth.

The codling moth, W. J. GREEN and J. S. HOUSER (*Ohio Sta. Bul. 160, pp. 197–214, pls. 5*).—The codling moth is described in its various stages, with notes on its life history.

It was found that 72 per cent of the worms left the apples before they fell. The destruction of windfall apples, therefore, seems to be of little avail. About 16 per cent of the worms were caught under bands. Adult larvæ were found throughout the growing season until October 13. The evidence obtained by the authors indicated 2 annual generations. In spraying experiments 91 per cent of the apples from sprayed trees and 57 per cent of those from unsprayed trees were free from worms. Arsenate of lead proved superior to arsenite of soda, and was not affected by mixing with Bordeaux mixture. This combination is recommended for controlling apple scab and codling moth.

Preliminary report on the codling moth in the Yakima Valley, E. JENNE (*Washington Sta. Bul. 69, pp. 16, figs. 3*).—As the result of a study of this pest in the Yakima Valley it was found that the insect is double brooded, with a partial third brood.

All commercial orchards in the valley are sprayed from 3 to 10 times. The loss from the codling moth in sprayed orchards is from 5 to 15 per cent. Of the larvæ which leave infested apples about 40 per cent crawl down the trunk of the tree and may be induced to pupate under properly placed bands. It is suggested that trees be sprayed first before the calyx closes and a second time 2 weeks later. For the second brood trees may be sprayed July 20, and August 5 and 30.

Some destructive grape pests in Ohio, A. F. BURGESS (*Ohio Dept. Agr., Div. Nursery and Orchard Inspection Bul. 5, pp. 17, figs. 4*).—Statistics are presented regarding the extent of grape culture in Ohio. The most important insect enemies of the grape in Ohio are grape root-worm, grape berry moth, and grape-blossom bud-gnat. The habits and life history of these 3 species are discussed in some detail, and suitable remedies are recommended for each pest.

In general it is urged that grapes be sprayed with Bordeaux mixture before the blossoms open, a second time with Bordeaux mixture and arsenate of lead while the blossoms are falling, a third time after an interval of 10 to 14 days, and a fourth time after another interval of about 10 days.

The most effective insecticidal treatment for the white fly, W. STUART (*Vermont Sta. Rpt. 1904, pp. 429–431*).—The white fly is a serious pest in winter-forcing tomatoes. Nicoticide, Aphis Punk, Fir-tree Oil, Lemon Oil, and X-all were tried and found to be of little avail.

Hydrocyanic-acid gas proved very effective. The cyanid was used at the rate of 0.014 to 0.2 gm. per cubic foot of space. The tomatoes were somewhat injured when the temperature of the greenhouse was high, but not at low temperatures, and the white fly was killed. Fumigation with doses of ½ oz. per 1,000 cu. ft. of space is recommended. At this rate the temperature should be 60 to 65° F. and the exposure of several hours' length.

Recent invasions of forest insects in Lorraine and means of combating them, E. HENRY (*Bul. Soc. Sci. Nancy, 3. ser., 5 (1904), No. 4, pp. 153–173, pls. 3*).—A general account is given of injuries from forest insects in Lorraine, with especial notes on *Hylobius abietis*, *Pissodes notatus*, *Tomicus bidentatus*, *Tortrix viridana*, etc. The remedies recommended against these forest pests are largely of preventive nature and consist in the destruction of the insects in their breeding places and the use of trap trees.

The elm leaf beetle, A. F. Burgess (*Ohio Dept. Agr., Div. Nursery and Orchard Inspection Bul. 4, pp. 23, figs. 10*).—This insect has recently appeared in injurious numbers in Dayton and other parts of Ohio. Notes are given on its distribution in various parts of this country and the habits, life history, food plants, natural enemies, and remedies for combating it. On account of the extremely dangerous character of this pest it is urged that effective insecticide remedies be put in operation against it.

The cocoanut beetle (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1905, No. 45, pp. 158–160*).—Brief notes are given on the habits and life history of *Rhyncophorus palmarum*. The beetle attacks many species of palms, but is most injurious to *Acrocomia lasiospatha*. In combating this pest the adults should be captured and destroyed as fast as possible and the decayed material of cut trees should be destroyed or treated so as to kill the larvæ.

Thrips and black blight, H. A. Ballou (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1904, No. 44, pp. 132–135*).—As a result of the study of this problem the author concludes that black blight causes an unsightly appearance of cacao, but is comparatively harmless. The scale insects which may precede the appearance of black blight are far more injurious, but may be controlled by the application of proper insecticide treatment. A number of instances are cited of the injury due to the cacao thrips (*Physopus rubrocinctus*).

The sheep maggot fly (*Bd. Agr. and Fisheries [London], Leaflet 126, pp. 3, figs. 3*).—*Lucilia sericata* is described in its different stages and notes are given on its life history and depredations on sheep. In combating this pest it is recommended that infested sheep be isolated, carcasses destroyed, and affected sheep be treated with kerosene and sulphur.

Preparation and use of sprays; spray calendar, W. Stuart (*Vermont Sta. Bul. 113, pp. 95–108*).—General directions are given regarding the principles of spraying for the control of insect and fungus pests, together with formulas for preparing Bordeaux mixture, copper sulphate solution, ammoniacal copper carbonate solution, formalin, Paris green, arsenate of lead, arsenite of soda, hellebore, kerosene emulsion, lime-sulphur-salt wash, pyrethrum, etc. A spray calendar is appended to the bulletin.

Electrical destruction of animal life (*West. Electrician, 36 (1905), No. 5, pp. 88, 89, figs. 2*).—An apparatus is described by which an alternating current of high voltage and low amperage can be passed through the bark of trees or through soil infested with insect or other harmful animal pests. It is claimed that these pests may be destroyed by the electric current.

The unimportance of the influence of stimulating food upon the egg laying of queen bees, Sylviac (*Apiculteur, 49 (1905), No. 4, pp. 149–155*).—As the result of a long-continued study of this subject the author comes to the conclusion that the rapidity and extent of egg laying on the part of queen bees is not greatly influenced by stimulation in the way of artificial feeding, but is determined largely by other well-known causes.

Regeneration of the thoracic feet of the silkworm, E. Verson (*Atti R. Ist. Veneto Sci., Let. ed Arti, 64 (1904–5), No. 2, pp. 429–469*).—The literature relating to this subject is briefly discussed and detailed notes are given on the special anatomical features of the thoracic legs of silkworms, with particular reference to regeneration processes as observed in these structures.

External characters which indicate sex in larvæ of the silkworm, E. Verson (*Atti R. Ist. Veneto Sci., Let. ed Arti, 64 (1904–5), No. 2, pp. 497–501, figs. 2*).—The author describes the structures which may be observed in the larvæ of the silkworm and which may be depended upon in classifying these larvæ according to their sex.

FOODS—HUMAN NUTRITION.

Macaroni wheat, J. H. SHEPARD (*South Dakota Sta. Bul. 92, pp. 39, pls. 4*).—Continuing earlier work (E. S. R., 15, p. 1098), results of studies of the milling and baking qualities of macaroni wheat are reported, as well as of its value for macaroni making.

In the investigations reported a number of samples of northern or Russian, southern or Mediterranean, and miscellaneous macaroni wheats were studied, in comparison with standard varieties of bread wheats. The milling tests showed that although some of the macaroni wheats were inferior, yet on an average this class of wheats compares favorably with standard bread wheats. As regards the varieties included in the present test, the best results were obtained with a specimen of Kubanka macaroni wheat.

"It yields a greater percentage of flour than any other. The color is not much different from the best blue stem flour, while . . . it makes a better loaf of bread than any other [of the samples tested].

"The Russian macaroni wheats as a whole give better results than the others, although there is a wide difference among the samples milled."

In a study of the distribution of protein in the different wheats, it was found that on an average the bread wheats tested contained 13.68 per cent protein in the whole wheat, 15.65 in the bran, 14.56 in the shorts, and 12.66 in the flour. The macaroni wheats tested contained on an average 15.60 per cent in the whole wheat, 15.90 in the bran, 15.29 in the shorts, and 15.00 in the flour.

From studies of the proportion of wet gluten present and the results of sponge tests, it appears that "the bread wheat glutens are slightly superior gram for gram, but the greater quantity in the macaroni seems to offset this advantage." The sponge test is regarded as a more accurate test of the tenacity of the gluten than the loaf volume, owing to the greater accuracy obtainable in the rise and measurement; and thus judged, the macaroni wheats compared favorably with the standard varieties.

A study of the bread-making qualities of the various wheats showed that the quality of macaroni flour bread was largely dependent upon the variety of wheat selected, some of the samples producing bread which in the author's opinion was equal or superior to that made from the best bread wheats, while the bread made from other varieties was of very poor quality. The data regarding the character of the macaroni made from the different samples of wheat have been summarized in the earlier bulletin previously referred to.

The color tests reported showed considerable range in the different samples, the macaroni flours comparing favorably with the standard wheats. In general, the color of the flour was found to depend directly upon the fineness of grinding. This, in the author's opinion, may explain some of the differences of opinion regarding the color of macaroni flour.

From a summary of data on the effect of soil and climate on the total protein in macaroni wheats, the conclusion is reached that these factors have not induced any general deterioration as regards protein content. In general an unfavorable season tends to lower the protein content and a favorable season to increase it. The percentage of gliadin in the total protein ranged in a number of samples of the macaroni flours examined, from 44.9 per cent with the Yellow Gharnovka, to 59.1 per cent with Kubanka. The proportion found in Blue Stem Minnesota wheat was 66.8 per cent.

A satisfactory flour for baking purposes should contain, according to the author, from 55 to 65 per cent of its total gluten in the form of gliadin. Therefore, judged by this standard, some of the macaroni flours are satisfactory while others are not.

In the author's opinion, the varieties containing the low gliadin content and poor baking qualities can not be improved by cultivation.

"The demand at present is for a durum wheat that will make good macaroni, an attractive flour, and a bread that is satisfactory in loaf, color, and flavor. This is much to ask of one variety of wheat, but our work leads us to believe that the problem is capable of a satisfactory solution. The key to success lies in choosing only the best kind or kinds for cultivation. After that the best localities for growing this best kind to perfection must be carefully determined.

"It is now well known that the macaroni wheats are preeminently dry weather wheats. This leads to the inevitable conclusion that the driest parts of our country are the natural habitats of these new wheats and it is to those localities we must look for our supply of the highest grade of macaroni wheat."

Report of the food commissioner, E. F. LADD (*North Dakota Sta. Rpt. 1904, pt. 2, pp. 1-180, 191-208, pl. 1*).—Detailed statements are made regarding the scope of the pure-food work in North Dakota, the results of the examination under the provisions of the State pure-food law of a large number of samples of sirups and sugars, preserves, jams, and jellies, canned goods, meats, catsups, candies, flavoring extracts, etc., and patent medicines, especially those containing large percentages of alcohol. Data are also given regarding the composition of a canning compound, a filler for tomato catsup and some other products.

The present condition of food adulteration in North Dakota, the use of preservatives and artificial coloring matters and other topics are discussed, and data regarding standards of purity are summarized, as well as information regarding the determination of methyl alcohol and the analysis of sugars and sirups. Information regarding the estimation and amount of sodium sulphite found in a number of samples of meat products and dried fruits is summarized from a publication previously noted (E. S. R., 16, p. 896).

The author considers that the character of the food products on sale in the State has improved, but that within the last year there has been a very large increase in the proportion of package goods showing short weight.

"Packages that are supposed to contain 16 oz. have been found to range from 10½ oz. to 16 oz. for different well-known brands. Baking powders have been found 1 and 2 oz. short. Extracts unlabeled, but supposed to contain 2 oz., would contain from 1½ to 1¾ oz. Cartons of dried fruit assumed to be 10 lbs. would net 8½ lbs. Packages of coffee sold for 25 lbs. would actually weigh less than 22 lbs. Our law is defective in that it does not require the placing of the net weight on every package of goods offered for sale in the State."

Food inspection, C. D. WOODS and L. H. MERRILL (*Maine Sta. Bul. 116, pp. 77-92*).—The provisions of the law enacted by the Maine legislature in 1905 to regulate the sale and analysis of foods are given. It is pointed out that this law contemplates "the proper and truthful branding of all articles of food, and the exclusion from the markets of deleterious food materials. The law does not seek to prevent the sale of any article of wholesome food; but in case a food material is other than it appears to be, it 'shall be plainly labeled, branded, or tagged so as to show the exact character thereof.'"

Saxony regulations regarding the sale of foods, condiments, and commercial products, E. WIMMER (*Die im Königreich Sachsen über den Verkehr mit Nahrungsmitteln, Genussmitteln und Gebrauchsgegenständen geltenden reichs- und landesrechtlichen Vorschriften. Leipsic: A. Rossberg, 1905, pp. 136; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 5, pp. 308, 309*).—In this volume, which is No. 168 of the series called *Juristischen Handbibliothek*, Saxony laws and regulations are summarized and some explanatory statements are given.

Examination of spices, W. FREAR, H. L. WILSON, and R. E. STALLINGS (*Pennsylvania Sta. Rpt. 1904, pp. 137-140*).—It has been suggested that the limits for ash

proposed by the committee on pure-food standards of the Association of Official Agricultural Chemists are not sufficiently wide to allow for the unavoidable contamination with clay, etc., sometimes met with in commercial products.

Analyses of a number of samples of gingers and peppers showed that the proposed limits were exceeded only in the case of one sample of Lampong black pepper. Analyses were made of the ash of the different milling products of two samples of pepper. The first or whitest product was found to contain as much ash as any portion except the last, and more ash insoluble in acid (sand or clay) than any other portion. "The sale of this light colored first product for genuine white pepper could be instantly discovered. The last portion, on the other hand, though highest in total ash, due to the excess of hull, is singularly free from sand and clay."

Analyses of the first, second, and third skins of pepper showed that the ash was most abundant in the outer skin, while the inside layers contained almost no ash insoluble in acid.

"While . . . the extract and piperin in the outer or first skin are much lower than those in the whole berry, the quantities in the second and third skins are very similar to those in the entire berry."

Determinations were also reported of the volatile and nonvolatile ether extract of a sample of Papua mace, a spice which has a very different flavor from true mace.

The value of condiments in the diet, O. LIEBREICH (*Ther. Monatsh., 18 (1904), pp. 65–68; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 6, pp. 368, 369*).—The data reported have to do with the effect of condiments on the stimulation of the flow of digestive juices and the effect on the chemistry of digestion. In the author's opinion condiments may be said to increase digestion when they increase the flow of digestive juices.

The need of sulphur in the diet, VON OEFELE (*Deut. Med. Presse, 9 (1905), No. 5, p. 39*).—The author estimates that an adult requires 3 to 3.5 gm. of sulphur per day, and points out that the amount metabolized in youth is greater than later in life. He discusses the need of supplying an abundance of sulphur, especially in disease.

Protein synthesis in the animal body, V. HENRIQUES and C. HANSEN (*Ztschr. Physiol. Chem., 43 (1905), No. 5, pp. 417–446, fig. 1*).—The experiments reported were made with white rats. The conclusions drawn follow:

Acid cleavage products of casein, even when taken in large quantity, can not protect the animal body from a loss of nitrogen. Nitrogen equilibrium can be reached or, indeed, gains of nitrogen made, when the bodies are taken which result from a long-continued action of trypsin plus erepsin on albumins. Loss of nitrogen can also be prevented by the products of trypsin digestion which are not precipitated by phosphotungstic acid (the monamino acids). The same is true for the tryptic digestion products which are soluble in warm 96 per cent alcohol. Apparently the tryptic digestion products which are insoluble in alcohol do not have the power of preventing a loss of nitrogen.

Concerning the chemistry of the peptic and tryptic digestion of proteids, II, D. LAWROW (*Ztschr. Physiol. Chem., 43 (1905), No. 5, pp. 447–463*).—The effect of hydrochloric acid in peptic digestion was studied. Some of the conclusions which were drawn follow:

In the slow peptic digestion of proteids (gelatin and hemoglobin) hydrochloric acid had a decided effect. A 0.5 per cent solution of hydrochloric acid caused a cleavage which apparently resulted in the production of monamino acids. Hydrochloric acid was also found to exercise a marked effect on the autodigestion of pig's stomach.

The presence of hexon bases and acid amids in meat, E. ZUNZ (*Ann. Soc. Roy. Sci. Méd. et Nat. Bruxelles, 13 (1904), No. 3; abs. in Zentbl. Physiol., 18 (1904), No. 26, p. 852*).—Hexon bases and amid acids having been found in the contents of the stomach and small intestine of dogs killed 2 to 8 hours after they had been fed veal, the

author endeavored to determine whether these bodies were formed during digestion or whether they existed in the meat. When 5 kg. of lean veal, taken three-quarters of an hour after the calf was slaughtered, was boiled 0.679 gm. histidin, 0.138 gm. arginin, 0.559 gm. lysin, 0.227 gm. leucin, 0.662 gm. glutaminic acid, and 0.371 gm. aspartic acid were recovered.

Physiology of muscular work, J. M. LAHY (*Rev. Sci. [Paris], 5. ser., 3 (1905), Nos. 7, pp. 201–204; 8, pp. 230–238; 9, pp. 267–273*). A general summary and discussion of investigations which have to do with food in relation to work, fatigue, and related questions.

The ash constituents of feces, VON OEFELE (*Deut. Med. Presse, 9 (1905), No. 2, pp. 12, 13*).—Data are summarized regarding the ash constituents of feces. The author points out that the greater part of the sulphur exists in volatile compounds or is ordinarily lost in analysis.

The mucin content of feces, VON OEFELE (*Deut. Med. Presse, 9 (1905), No. 3, p. 22*).—In normal feces, according to the author, mucin constitutes only 2.02 per cent of the total dry matter. The amount seems larger on account of the large volume of water retained by the mucus. It is noted that part of the quantity present may be pseudo-mucin.

ANIMAL PRODUCTION.

Studies upon the composition of timothy hay, W. FREAR ET AL. (*Pennsylvania Sta. Rpt. 1904, pp. 40–115*).—With a view to securing a more exact knowledge of the composition of timothy hay, studies were undertaken which include a determination of a considerably larger number of constituents than is ordinarily taken into account in analysis of feeding stuffs and studies of the heat of combustion.

In every case the analytical methods are described in detail and numerous references are made to the literature of the subject. In the case of the calorimetric investigations, determinations were made of the different constituents removed from the hay by the solvents used and also of the extracts obtained by the use of solvents. In the latter case, cellulose blocks were saturated with the material tested, parallel determinations being made with the solvents used and the heat of combustion of the material extracted determined by difference. The following table summarizes the data regarding the composition of the dry matter of the timothy hay:

Composition of dry matter of timothy hay.

	Per cent.
Ash	4.730
Protein:	
Amid nitrogen as asparagin (N × 4.7)	.768
Albuminoids (albuminoid N × 6.25)	5.610
Cellulose (ash-free chlorination residue)	29.720
Lignic acids (including undetermined matter of alkali extract, less xylan disappearing during the extraction)	9.601
Hexosan (?) found in alkali extract	1.985
Hemicellulose, not xylan, decomposed by weak sulphuric acid	9.607
Hexosan (?) soluble in warm water	1.420
Xylan (including a little araban)	23.230
Reducing sugars, as dextrose	1.093
Sucrose	.909
Fat, waxes, resins, and colors (including all of ether extracts except the parts soluble in water and weak acid, and including the water-insoluble alcohol extract)	4.185

	Per cent.
Undetermined (including acids, part of the mucilage of the water extract, etc.):	
Petroleum ether extract	.056
Sulphuric ether extract	.354
Absolute alcohol extract	.671
80 per cent alcohol extract	3.860
Water extract	3.387

Owing to a slight discrepancy in the amounts of undetermined material calculated by difference and by detailed figures for the several extracts, the sum of the results as given is not exactly 100. Some of this undetermined material has already been divided into groups in the course of the investigations reported, but the author considers that the most important question to be studied is the determination of the nature of the hemicellulose—non-pentosans of the acid extract, and the hexosan (?) and lignic acid of the alkali extract.

The heat of combustion of the original hay and of the residues from the different reagents used in determining its composition is as follows, the figures being calculated on an ash-free basis:

Heat of combustion of ash-free timothy hay and its constituent parts.

	Calories.
Original hay	5,805
Residues:	
From petroleum ether extraction	4,722
From sulphuric ether extraction	4,613
From absolute alcohol extraction	4,644
From 80 per cent alcohol extraction	4,629
From cold water extraction	4,666
From dilute acid extraction	4,780
From dilute alkali extraction	4,444
From chlorination	4,118

The author's comments on some of these energy values follow:

"Confining attention to the extracts that form large fractions of the entire hay, we find that the dilute acid extract, composed chiefly of hemicellulose has a somewhat higher value than that ordinarily assigned to polysaccharids, viz, 4,100 to 4,230 calories.

"The value for the alkali extract is still higher. The value for the 'lignic acid' has been computed from the percentages of dextrose, polysaccharid or pentosan and albuminoids, allowing 3,762, 4,180 and 5,900 calories for their respective heat values; the value thus deduced for the undetermined ash-free residue, 'lignic acid,' is 5,281 calories.

"The heat value of the residue from the alkali extraction, crude fiber, is 4,368 calories without correction for ash, or 4,444 calories with such correction. . . .

"The heat value for the chlorination extract is very high. It must, however, be remembered that this value, obtained by difference, may be explained either by the low heat value of the chlorination residue or the high heat value of material removed during chlorination. The former explanation appears the more probable, since the chlorination process is distinctly oxidizing in its tendencies and the cellulose residue has the properties in part of an oxycellulose. Such an oxidation would naturally reduce the heat value of the residual organic matter."

The chemical composition and nutritive value of oats, F. TANGL, M. KORBULY, and S. WEISER (*Landw. Jahrb., 34 (1905), No. 1, pp. 65–92*).—Studies are reported on the composition and digestibility of Hungarian oats, the digestion experiments being made with both horses and sheep. The average coefficients of digestibility follow:

Coefficients of digestibility of oats.

	Organic matter.	Protein.	Ether extract.	Crude fiber.	Nitrogen-free extract.	Pentosan.	Availability of energy.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Horse	59.7	68.2	54.0	7.1	69.3	15.2	58.7
Sheep	66.3	63.8	62.6	40.3	72.0	36.1	64.5

The authors calculate that with horses the physiological nutritive value of oats was 54.8 per cent and with sheep 53.85 per cent.

Sorghum seed as a feeding stuff, F. TANGL, S. WEISER, and A. ZAITSCHEK (*Landw. Jahrb., 34 (1905), No. 1, pp. 3–64*).—Data on sorghum as a feeding stuff are summarized, and an extended series of investigations are reported on the composition and feeding value of sorghum seed (*Sorghum vulgare*).

Investigations were made with horses, steers, milch cows, sheep, pigs, and different sorts of poultry. In the majority of the tests the digestibility was studied as well as the income and outgo of nitrogen, and in some cases the energy balance was calculated. In general the sorghum seed was fed with other materials and its digestibility calculated from the data obtained for the ration as a whole. The following table shows the average coefficients of digestibility with different farm animals:

Coefficients of digestibility of sorghum seed.

	Organic material.	Protein.	Ether extract.	Crude fiber.	Nitrogen-free extract.	Starch.	Pentosan.	Availability of energy.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Steer	77.9	49.2	76.9	68.3	85.2	97.8	52.0	75.6
Sheep	74.2	55.9	84.0	17.1	79.2	87.6	....	72.0
Horse	63.7	41.5	60.6	28.7	74.1	82.5	24.4	66.3
Pig	75.8	60.3	71.6	19.8	83.3	98.5	44.9	72.5

The authors also calculated the physiological nutritive values. With ducks and geese the values were 46.7 and 57.1 per cent. With farm animals the figures varied from 56.5 per cent with sheep to 68.7 per cent with pigs. According to the authors, not more than 6 kg. of sorghum seed per 1,000 kg. live weight should be fed to steers. Larger quantities diminish its digestibility. It was found that substituting 1.33 liters of sorghum seed for a liter of corn gave good results with milch cows, though when cost was considered the advantage was with the corn.

The authors do not consider sorghum seed alone a satisfactory grain ration for horses, but consider it satisfactory when fed with double its amount of oats, the maximum amount recommended per day being 2.5 kg. On the basis of experimental data sorghum seed is considered a satisfactory feed for pigs. The raw seed was somewhat better digested than the cooked. Corn and sorghum mixed were not as well digested as when fed separately, since the sorghum is digested with difficulty and diminishes the digestibility of the corn. Sorghum is not considered a satisfactory feed for fattening chickens and ducks, but may be used for turkeys and geese, 1.5 kg. being equal to a kilogram of corn.

The digestibility of galactan, J. B. LINDSEY (*Massachusetts Sta. Rpt. 1904, pp. 78–84*).—In a test with 3 sheep, the digestibility of galactan was studied, the

feeding stuff selected as containing a fairly large amount of this constituent, being alsike clover seed which was fed with hay.

The dry matter of the alsike clover seed contained 34.29 per cent protein, 5.29 per cent fat, 41.42 per cent nitrogen-free extract, 13.12 per cent crude fiber, 5.88 per cent ash, and 8.07 per cent galactan. The composition of the dry matter of the hay was also given, the amount of galactan present being 1.72 per cent. On an average the coefficients of digestibility of the alsike clover seed were: Dry matter 80.49, galactan 95.78, protein 74.73, fat 84.55, nitrogen-free extract 86.26, crude fiber 86.04, and ash 51.21 per cent. The coefficient of digestibility of the galactan of hay was 75.35 per cent. Data are also recorded for the other constituents of the hay.

"All 3 sheep digested the galactan in the clover seed quite thoroughly. Such a result was to have been expected, for the reason that in the seed the galactan is supposed to be comparatively free from incrusting substances, which have been shown by various investigators to seriously interfere with the digestibility of the several fodder groups.

"Naturally, no positive conclusions should be drawn from the present single investigation. Knowing, however, the physiological and chemical character of the galactan, as well as the digestion coefficients obtained with starch and with the pentosans—bodies of similar character—it is reasonably safe to conclude that the results secured gave a fairly correct idea of the ability of the animal to utilize the galactan group."

Composition and digestibility of distillers' dried grains, A. K. RISSER (*Pennsylvania Sta. Rpt. 1904, pp. 221-238*).—Data regarding the composition of distillers' grains are summarized, and digestion experiments reported which were made with two sheep.

In the first period the ration consisted of hay, and in the second of hay and distillers' grains (Biles fourex), the digestibility of the distillers' grains alone being calculated in the usual way. The average coefficients of digestibility of the hay follow: Dry matter 50.18, protein 15.12, ether extract 14.76, nitrogen-free extract 49.75, crude fiber 60.83, and ash 48.92 per cent. The heat of combustion of the digested material was 47.43 per cent of that of the energy of the food eaten.

For the distillers' grains the values were: Dry matter 71.24, protein 65.32, ether extract 94.11, nitrogen-free extract 87.87, and crude fiber 58.98 per cent. The energy of the digested food was 71.64 per cent of that of the food eaten.

The respiration calorimeter at the Pennsylvania Experiment Station, H. P. ARMSBY (*Pennsylvania Sta. Rpt. 1904, pp. 208-220, pls. 6*).—This article is reprinted from the Experiment Station Record (15, p. 1037).

Condimental feeds and condition powders, J. P. STREET (*New Jersey Stas. Bul. 184, pp. 27*).—Microscopical, proximate, and ash analyses are reported of 50 samples of condimental foods and similar goods. Of these 17 were stock feeds, 14 poultry feeds, and 18 condition powders or tonics. The goods represent the product of 29 manufacturers and 23 were brands not previously analyzed at the experiment stations.

The goods were found to consist essentially of common drugs such as fenugreek, gentian, glauber salts, pepper, charcoal, oyster shells, etc., with common feeding stuffs such as corn meal, wheat, bran, and linseed meal. Data are given regarding the medicinal properties and dose of the drugs commonly used in condimental feeds.

"The claims of the manufacturers of condimental feeds, when not preposterous, are exaggerated and misleading. No one feed, however skillfully compounded, can serve as a remedy for all the ailments of all classes of live stock.

"Instead of being prepared according to scientific formulas, as claimed, many of the condimental feeds are heterogeneous mixtures, with little regard to the requirements of the animal, and in certain cases the drugs used have a counteracting effect on each other.

"Even where effective drugs have been used, the amount of the mixture to be given to the animal, according to the instructions of the manufacturer, is generally so small that no possible benefit can be expected from its use."

It is pointed out that the excessive cost of these feeds "would prohibit their use by the careful and economical feeder" who could obtain and mix for himself the ingredients likely to be of value "at from one-tenth to one-twentieth the cost of the prepared foods."

Concentrated feeding stuffs, J. P. STREET, W. P. ALLEN, and V. J. CARBERRY (*New Jersey Stas. Bul. 185, pp. 38*).—The feeding stuffs analyzed under the provisions of the State feeding stuffs law included 397 samples of cotton-seed meal, linseed meal, cocoanut cake, germ-oil meal, gluten meal and feed, hominy meal, corn, bran, or sugar feed, cerealine feed, germaline, maizeline feed, distillers' grains and similar goods, malt sprouts, dried brewers' grains, molasses grains and feeds, mixed and proprietary feeds, barley feed, dried-beet pulp, stock feed made from sugar beets, peanut bran, peanut middlings, rice feed, poultry feeds, animal meal and calf meal, wheat-bran middlings and feeding flour, wheat and rye middlings, rye bran and feed, corn meal, ground mixed grains, cracked rice, "corn-wheat" and buckwheat middlings, bran, and feed.

Of the 159 different brands of feed received, and which should have been guaranteed, 14 failed to meet this requirement. Consumers should at all times insist upon a guarantee, except for milling products, for which no guarantee is required.

Of the 288 samples which were guaranteed, 114 were deficient, 75 of these being low in protein.

Of the 95 samples which did not require a guarantee, 79 were of normal composition, 12 were of inferior grade, and 4 were misbranded.

Nine samples were found to be adulterated—linseed meal with cocoa shells, dried brewers' grains with coffee hulls and wheat feed with corncob.

The constantly increasing number of brands upon the markets requires, on the part of the purchaser, close attention to the amount of nutrients guaranteed and the prices asked for the same.

The purchaser of protein will rarely find any feed containing less than 15 per cent of protein a desirable or an economical purchase.

Analyses of miscellaneous feeding stuffs, M. H. PINGREE (*Pennsylvania Sta. Rpt. 1904, pp. 116–123*).—The analyses reported include cotton-seed meal and feed, sugar and oil meal, linseed meal (old and new process), flaxseed hulls, wheat bran, middlings, and mixed feed, Red Dog flour, wheat, gluten meal and feed, hominy, hominy feed and chop, corn, buckwheat middlings, distillers' grains, brewers' grains, molasses feed, beet-pulp feed, royal palm (*Oreodoxid regia*) berries, meat meal and similar goods, dried blood, and mixed and proprietary feeds.

Commercial feeding stuffs, H. J. WHEELER ET AL. (*Rhode Island Sta. Bul. 105, pp. 95–107*).—Under the provisions of the State law regarding the sale of commercial feeding stuffs analyses were made of a number of samples collected in the winter of 1904–5 including cotton-seed meal, linseed meal, gluten meal and feed, commercial mixed feeds, proprietary feeds and similar goods, wheat bran, ship stuff, middlings and shorts, hominy feed chop and similar products, corn meal, provenders, brewers' grains, distillers' grains, molasses grains, malt sprouts, stock feeds, calf meal, poultry feeds, dried molasses-beet-pulp, and peanut bran.

One of the cotton-seed meals examined was apparently very grossly adulterated with cotton-seed hulls. A mixed feed was also much adulterated and wheat bran and a number of samples of gluten feed and meal were below the guarantees in certain respects.

Security stock food, E. F. LADD (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 29, 30*).—An analysis of this proprietary feeding stuff failed to bear out the claims made for it.

The principles of feeding and physiology of metabolism with special reference to farm animals, F. TANGL (*Landw. Jahrb., 34 (1905), No. 1, pp. 1, 2*).—The investigations, which are being carried on at the experiment station in Budapest for the study of animal physiology, are briefly outlined.

Live-stock score cards (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 138–147*).—Specimens are given of the score cards used by the students at the North Dakota Agricultural College for judging live stock.

Calf rearing, W. T. LAWRENCE (*Jour. Bd. Agr. [London], 11 (1905), No. 12, pp. 705–716, figs. 3*).—The system of feeding calves practiced by a successful feeder in the north of England is described, the data being based on observations extending over a period of 9 years.

After 2 weeks whole milk is gradually replaced by skim milk and cream substitutes, those which have given the most satisfactory results being boiled linseed, ground linseed, and cod-liver oil. The scalded ground linseed is considered the most satisfactory. Two sorts of calf meal of domestic manufacture are spoken of, and rations suggested in which they are used.

Regarding the use of cotton-seed meal, the following statements are made:

"Loss among calves is often attributed to the use of cotton cake with the cows, but at this farm the cows when housed get in the regular way 4 lbs. of decorticated cake each per day, and for the latter half of the summer 2 lbs., and yet, with the exception of [5 calves which died from other causes], there have been no losses in 9 years out of a total of 180 calves born. It should, however, be stated that when a cow's milk falls to 5 qts. a day cake is entirely discontinued, as she does not pay for it and can be kept in good condition without it, so that practically no cow gets cotton cake for at least 2 months previous to calving, nor does she get cake in the week following; but after the first week of its life a calf is fed with the milk of any cow, or with the milk of several, that are receiving the usual allowance of cotton cake."

Calf feeding experiments, J. MAHON (*Queensland Agr. Jour., 15 (1905), No. 7, pp. 825, 826*).—In a test covering 6 weeks it was found that the average daily gain of 4 calves fed 2 oz. of cod-liver oil and 3 gal. of skim milk was 1.88 lbs., as compared with 1.66 lbs. in the case of calves fed a ration of 10 oz. of pollard, 3 oz. linseed meal, 2 oz. molasses, and 3 gal. skim milk. "The use of cod-liver oil facilitates the feeding of calves, and also lessens the danger of scouring which frequently occurs when improperly prepared or unsuitable food is fed to calves."

Raising calves on skim milk and pasture, J. S. MOORE (*Mississippi Sta. Rpt. 1904, p. 22*).—Calves were put on a skim-milk ration when 5 days old and fed grain and hay in addition as soon as they would eat it. In 391 days, the average weight was 496 lbs., and the total cost of the feed $11.47 per head.

How four hundred calves were wintered on ensilage, H. JONES (*Prairie Farmer, 77 (1905), No. 22, p. 1, fig. 1*).—Calves were fed corn and soy-bean silage ad libitum (25 to 30 lbs. per day), with clover, alfalfa, and oat hay. The grain ration consisted of 1 to 2 lbs. of cotton-seed meal, and for the last 6 weeks 5 lbs. corn-and-cob meal also. The average daily gain in the 5 months of the test was 1.78 lbs. per head, and the cost of a pound of gain 3.6 cts.

Experiment in beef production, W. J. KENNEDY ET AL. (*Iowa Sta. Bul. 81, pp. 337–372, figs. 25*).—Using 2 Jersey and 2 Holstein steers as representatives of the dairy breeds, and 2 Angus and a like number of high-grade Hereford steers as representatives of the beef type, a feeding test covering a year was made.

Both lots received the same ration of mixed grains and mixed hay with sorghum during July and August. The rations varied from month to month, the amount of corn being increased as the feeding period progressed. The average gain per steer in the case of the beef type was 606 lbs.; the average amount of dry matter required

per pound of gain 10.84 lbs., and the cost of a pound of gain 7.81 cts. In the case of the steers of the dairy type, the average gain was 597.75 lbs., the dry matter required per pound of gain 10.666 lbs., and the cost of a pound of gain 7.63 cts.

After slaughtering, the steers were used in demonstration work and the results of the slaughter tests were recorded in full in order to secure information regarding the differences in distribution of the meat in the two types. According to the author, the steers of the dairy type showed a considerably higher proportion of offal and a lower percentage of dressed weight, a higher percentage of fat on the internal organs, and consequently an increase in the total weight of the cheap parts. With the beef steers, the higher percentage of valuable cuts was noted.

"Beef type steers furnish heavier, thicker cuts; they are more evenly and neatly covered with outside fat, show superior marbling in flesh, are of a clearer white color in fat, and a brighter red in the lean meat; but there is little difference in fineness of grain.

"The low price paid for dairy steers may be due partially to prejudice and to the greater expense of carrying and selling the low-grade carcasses; but it is chiefly due to an actual inferiority in the carcasses.

"It is neither profitable nor desirable to feed steers of dairy type for beef purposes. They are unsatisfactory to the consumer, because they do not furnish thick and well marbled cuts; they are unsatisfactory to the butcher, because they furnish low-grade carcasses which are difficult to dispose of, and they are decidedly unsatifactory to the feeder, because they yield him little or no profit, and both breeder and feeder waste their time in producing such a type of steer for beef purposes."

Experiments with cattle, E. R. LLOYD (*Mississippi Sta. Rpt. 1904, pp. 14, 15*).—Data are given regarding the gains made by 2-year-old steers and by calves on pasturage. The largest gain, 300 lbs. per head, was noted with 2-year-old steers pastured from March 26 to November 1. The smallest gain, 218 lbs , was noted with calves.

In a test of the comparative feeding value of different hays it was found that 3 steers fed 4,000 lbs. of oat hay lost 40 lbs. in 103 days. A similar lot fed a like amount of Johnson-grass hay lost 50 lbs. while a lot fed practically the same amount of wheat-hay gained 13 lbs.

The comparative value of different rations containing cotton seed, and cotton-seed meal and hulls was studied with 5 lots of 5 steers each, the feeding period covering 120 days. The greatest gain, 690 lbs., was made by a lot fed a ration of cotton-seed meal and hulls. The smallest gain, 455 lbs., was made by a lot fed raw cotton seed, shelled corn, and sorghum hay. Data are also recorded regarding the dressed weight, the percentage of fat in the carcass, and the loss of weight in shipping.

From statistics which are given the average cost of feed for wintering the station cattle was $6.01 and sheep 65 cents.

Steer-feeding experiments, G. H. TRUE, T. F. MCCONNELL, and R. H. FORBES, (*Arizona Sta. Bul. 50, pp. 499–522, pls. 2*).—Of the 4 tests reported on the comparative value of alfalfa alone and supplemented by such coarse fodders as sorghum, the first has been noted from another publication (E. S. R., 12, p. 1074).

In the second trial a lot of 2 two-year-old steers on alfalfa and alfalfa hay made an average daily gain in 188 days of 1.58 lbs. per head. The gain made by a similar lot fed wheat hay and cured sorghum in addition to green alfalfa and alfalfa hay was 1.50 lbs. per head per day, and by a lot fed some rolled barley in addition to alfalfa fresh and cured, wheat hay, and cured sorghum 1.87 lbs.

The third test was made with 2 lots each containing 11 yearlings and covered 485 days. The lot fed principally alfalfa made an average daily gain of 1.21 lbs. per head, and the lot fed a ration of sorghum hay, wheat hay, etc., in addition to alfalfa 1.26 lbs. In the fourth test, which covered 522 days, 4 steers fed alfalfa as a soiling crop, hay or both, in the different periods, made an average daily gain in the whole test of 1 lb. per head as compared with 0.98 lb. in the case of a lot fed alfalfa supple-

mented principally by sorghum hay. In connection with this test 1 lot of 4 steers was kept on alfalfa pasturage to compare this method of feeding with the data obtained by the use of alfalfa as a soiling crop or hay. In 518 days there was an average daily gain on the alfalfa pasturage of 1.01 lbs. per head. From the data included in the bulletin the general conclusion was drawn that the combination rations containing alfalfa were about equal in feeding value to rations of fresh and cured alfalfa.

In all cases the shrinkage when steers were dressed was taken into account, and the conclusion was reached that although the differences were small yet this factor was slightly greater with the lots fed alfalfa combined with other materials than on alfalfa alone.

"Since alfalfa, where conditions are favorable for its production, yields the most abundant and cheapest forage grown in the Southwest, the high percentage of protein may be disregarded, although theoretically a carbohydrate feed, such as sorghum or grain hay, should be fed with it to secure the more thorough utilization of the protein of the alfalfa by the animal. In situations where alfalfa can not be produced to advantage, as with scant water supply and on excessively alkaline soils, carbohydrate rations may often be grown, especially of the sorghum class, which in combination with alfalfa give results about equal to those from the all-alfalfa ration. Sorghum rations alone are undoubtedly inferior to alfalfa alone and in combination with alfalfa yield greater gains than when fed alone.

"The quality of the meat from alfalfa-fed steers appears to be about the same as that from animals fed on the combined rations used. Animals finished with barley yielded meat of distinctly better quality, but the slight advance in price obtained did not make return for the barley fed.

"Assuming the approximately average and representative character of the forages used, the yields obtained, and the animals employed, the results of these experiments indicate that under southwestern conditions, where alfalfa may be fed or pastured all or nearly all the year, this forage is the most abundant and the cheapest feed available, giving as good gains of as good quality as can be economically produced."

Methods of steer feeding: Barn v. seed, T. I. Mairs and A. K. Risser (*Pennsylvania Sta. Rpt. 1904, pp. 197–204*).—Twelve steers fed in barns for 98 days made a total gain of 2,760 lbs., while a similar lot fed like rations in sheds gained 2,724 lbs. The test reported has been abstracted from another publication (E. S. R., 16, p. 398).

Digestion experiments with sheep, J. B. Lindsey et al. (*Massachusetts Sta. Rpt. 1904, pp. 45–77*).—Continuing earlier work (E. S. R., 16, p. 395), a number of digestion experiments with sheep were made, each covering a period of 14 days of which the first 7 were regarded as preliminary. The different materials tested were fed with meadow hay, the digestibility of the special feeds being calculated in the usual way. A summary of the work follows:

Coefficients of digestibility of feeding stuffs in experiments with sheep.

Kind of feed.	Number of tests.	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.	Ash.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
Soy-bean fodder	3	63.53	82.96	65.12	77.82	38.90	21.05
Eureka silage corn fodder (green)	3	66.63	67.02	65.93	72.44	60.26	42.21
Eureka silage corn fodder (dry)	2	63.84	57.04	62.43	63.82	71.56	40.34
Apple pomace	3	70.60	....	43.41	84.30	67.31	42.81
English hay, young sheep	5	52.00	37.36	40.49	57.83	52.96	17.89
English hay, old sheep	2	58.66	42.36	46.37	64.14	60.87	22.16
Bibby's dairy cake	6	69.96	65.51	92.44	81.16	46.15	33.08
Dried molasses beet pulp	2	84.51	64.08	....	91.08	83.87	61.52
Blood meal	2	....	84.00	....	....	....	....
Medium green soy-bean meal	2	89.72	91.51	93.13	82.24	113.55	69.61
Hominy feed and chop	6	80.09	62.78	92.52	87.85	60.68	32.05

The principal conclusions which were drawn follow:

Apparently owing to the characteristic hard-wood stems, the total dry matter of soy-bean fodder seemed slightly less digestible than that of other legumes such as clover, Canada field peas, and cowpeas. Apple pomace was found to be as digestible as the better grades of corn silage. English hay was fairly digestible, and no great variations were noted due to individual peculiarities, though on an average, young sheep did not digest the material as thoroughly as old sheep.

In general the author considers that Bibby's dairy cake was only moderately well digested, and possesses a nutritive value similar to standard wheat middlings. Considerable difficulty was experienced in digesting the crude fiber, probably owing to the fact that it was derived largely from cotton-seed hulls. The sheep ate dried molasses-beet-pulp readily and digested it without trouble, and the author believes that this material has a feeding value about 10 per cent less than corn meal.

Judging from the experimental data, the author considers that the protein of blood meal is quite thoroughly utilized by farm animals. Soy-bean meal was on an average quite thoroughly digested, especially the protein and fat, its two most important constituents. As compared with the average results for corn meal, hominy feed, or chop gave somewhat lower coefficients of digestibility. "It has been assumed hitherto that hominy was as digestible as corn meal; but in view of the results obtained, this opinion is no longer tenable."

As regards the results obtained with Eureka corn fodder, the author considers them very favorable as compared with those obtained by other experimenters with other varieties of corn at a similar stage of growth. In general the dry fodder was not as well digested as the green material. "This may be accounted for partly on the ground that the sheep received the green fodder in September, after having been at pasture all summer, while the dried material was fed in March, after they had been in similar experiments for 6 months; and partly because previous experiments have demonstrated that in case of very coarse fodders sheep digest the green substance a little more thoroughly than the cured."

Effects of feeding cotton-seed meal upon the health of animals, E. FULMER (*Washington Sta. Bul. 67, pp. 28-42*).—This contains a summary of the data recorded by experiment station investigators on the effects of cotton-seed meal on the health of animals, and deductions drawn from facts obtained in connection with the author's investigations.

Of the 23 animals used in the tests with cotton seed at the Washington Station, only one died. This pig weighed 131 lbs., and had consumed 47 lbs. of cotton-seed meal, a quantity equal to 35.9 lbs. per 100 lbs. body weight. The feeding periods ranged from 14 to 98 days in duration, and in no other case were functional disorders noted. The amounts of cotton-seed meal eaten by the different pigs ranged from 7.7 to 154 lbs.

"The cool weather during the feeding period, the nature of the grain ration (chopped barley, oats, or wheat), the abundance of succulent food fed, and the opportunities for exercise, all doubtless had an influence upon the successful issue of these experiments, regarded from the standpoint of the stockman.

Cotton food products in hog feeding, R. R. DINWIDDIE (*Arkansas Sta. Bul. 85, pp. 1-26*).—Continuing the studies of cotton-seed products for pigs (E. S. R., 15, p. 68), 11 tests were made in which cotton-seed meal or chopped cotton seed were fed with different combinations of grain, cotton-hull bran, and cowpea hay; 2 in which crude cotton-seed oil was fed with bran and corn, and 1 for purposes of comparison in which the ration was composed of bran and shorts. The amounts of cotton seed eaten and the gains in weight are recorded, as well as the weight of the liver and kidneys and the melting point of the leaf lard and the body lard. The author's summary follows:

"The toxicity or otherwise of cotton-seed meal for hogs, just as for cattle, is a question of dosage. Small amounts may be fed indefinitely, larger quantities for a limited

period only, without inducing toxic symptoms. The toxic allowance is determined by the amount per day rather than by the absolute amount fed. Thirty pounds fed in 30 days may cause fatal poisoning while amounts up to 150 lbs. in proper daily allowance have been fed without harmful effects. In feeding cotton-seed meal to pigs the daily allowance in general should be arrived at from the age and weight of the animals.

"For continuous feeding the following allowances appear to be well within the danger limit: Pigs under 50 lbs., one-fourth pound per day. Pigs from 50 to 75 lbs., one-third pound per day. Pigs from 75 to 100 lbs., 0.4 lb. per day. Pigs from 100 to 150 lbs., one-half pound per day. If fed a full grain allowance, the dosage may be obtained by properly proportioning the cotton-seed meal to the other components of the ration, namely, 1 to 5, 6, 7, or 8, according to the stage of growth. When pigs obtain part of their feed by grazing a proportion of 1 to 4 or 1 to 5 can be fed by diminishing the grain allowance. A meal ration containing cotton-seed meal should also contain at least an equal amount of wheat bran to supply bulk. For the remainder, corn appears to be the only choice.

"In a ration for hogs cotton-seed meal can only be used as an adjunct and corrector for a basal corn ration, and this is obtained by the proportions mentioned. At the price prevailing and likely to prevail for cotton-seed meal it is doubtful if larger amounts could be economically fed even independent of the toxic effect of the food. In the amount prescribed above cotton-seed meal can be fed indefinitely as to the time just as any other feed. With the same breed of pigs a ration of cotton-seed meal, bran, and corn in various proportions has made quicker and more profitable gains than bran and corn alone, and this at all stages of growth.

"Cotton-seed meal has not been found to exert any specially harmful influences on breeding stock independent of its general toxic effects. Cotton seed (chopped), although eaten at first reluctantly and always with some waste, seemed so to supplement or economize the corn ration, with which it was fed, that a relatively cheap production of pork was produced by its use. (Based on one test only.) It would seem that on account of its cheapness to the southern farmer it might, if fed carefully, be utilized in pork growing. The daily allowance should be about the same as for cotton-seed meal and the feeding done in such a way that this allowance could not be exceeded. Cotton seed and corn make probably the best combination, about 1 to 6 or more if on full feed, or 1 to 3, 4, or 5 if on short allowance of grain.

"Where hogs are allowed free access to cotton seed they will likely poison themselves unless freely supplied with other food, in which case the amount eaten may not be sufficient to cause poisoning. We have had no experience with cotton seed rotted, roasted, steamed, or otherwise treated, but believe the harmful influence to be about the same in character and degree as in cotton-seed meal, being located in the kernel or 'meat.' Cotton-seed hulls are not toxic for hogs, and hence probably not for cattle either. They are only available for hog feed when ground into a 'bran,' and at the price charged this 'cotton-hull bran' is unprofitable. 'Cotton-seed feed' should also be avoided as a hog feed.

"Crude cotton oil when fed apart from the kernels has not occasioned symptoms such as we found in cotton-seed meal poisoning, although in the quantities fed it seemed to act harmfully, giving rise to unthriftiness and possibly even death. These conditions may be the effect of an overoleaginous ration or of a special toxin. Our trials have not yet decided this matter.

"The economy or profit to the southern planter of feeding cotton seed or cotton-seed meal to hogs is a subject worthy of more extensive investigation than it has yet received, such investigations being made along the lines suggested in this report. Guided by these suggestions as to rations, the prospect is favorable, but feeding in ignorance or indifference of these will only result in loss. The idea that cotton-food

products can ever take the place of corn in pork production in the South may well be abandoned. They can not replace but may prove valuable adjuncts to corn or any other starchy or carbohydrate food which may be found available in the South for hog feeding. The conditions here are not the same as in cattle feeding where the hulls are available for roughage."

The tests reported in the author's opinion do not afford much opportunity for judging of the nature of poisoning due to cotton seed. In so far as can be judged from the data obtained, he considers that cases of overfeeding with cotton seed or cotton-seed meal induce "congestion of the eliminative organs (liver or kidneys), followed by one of three conditions, according to the degree of overfeeding, namely:

"(a) Progressive engorgement with impairment of function leading to acute dropsical effusion into the various serous cavities and death within two months or less. This is the most acute form.

"(b) Primary engorgement as above followed by degenerative changes, fatty and atrophic in the liver, sclerotic and atrophic in the kidneys, with progressive loss of function.

"(c) Congestion of less degree which the organs become more or less habituated to and in which only slight and temporary symptoms develop and no marked organic changes are found.

"(d) Long-continued feeding on cotton-seed meal in the safe doses prescribed above has given rise to no gross organic changes in liver, kidneys, or other organs discoverable on slaughter. No fault has been found by the butcher purchasing our animals as to the quality of the flesh or fat. Prolonged feeding on cotton-food products has been found to greatly heighten the melting point of the lard."

Experiments with hogs, E. R. Lloyd (*Mississippi Sta. Rpt. 1904, pp. 12, 13*).—In a study of the value of alfalfa pasturage without grain, 14 pigs 2 months old gained only 33 lbs. in 37 days on 1.33 acres of alfalfa, indicating that without additional food alfalfa is "about a maintenance ration for growing pigs." When all the ripe sorghum which would be eaten up clean was fed, in addition to corn equal to 1.4 per cent of the weight of the pigs, the ration was found a little more than sufficient for maintenance.

Fourteen young pigs, running with their dams, pastured on 1.66 acres of cowpeas, made an average daily gain of 1 lb. for a period of 23 days. In a study of the gains made by pigs fed grain, as compared with those following steers and fed a small amount of grain in addition, it was found that 7 pigs fed grain in a pen made a total gain of 299 lbs. in 54 days, requiring 4.7 lbs. of grain per pound of gain, at a cost of 4.88 cts. per pound. The gain made by a similar lot following steers was 262 lbs. In addition to what they could gather, these pigs required 1.3 lbs. of grain per pound of gain at a cost of 1.15 cts. per pound.

Feeding pigs on skim milk and pasture, J. S. Moore (*Mississippi Sta. Rpt. 1904, pp. 22, 23*).—The comparative value of oats and vetch, alfalfa, and sorghum as green feed was studied with pigs in consecutive periods of 31, 132, and 31 days, the test being supplemented by a period of 45 days on skim milk and corn. Some corn was fed with the oats and vetch and with the sorghum.

The greatest gain, 0.9 lb. per head per day, was noted on oats and vetch and the smallest, 0.03 lb. per day, on sorghum. On skim milk and corn the average daily gain was 0.8 lb. per head. Considering the test as a whole, the cost of a pound of gain ranged from 1.44 cts. on alfalfa pasturage to 25 cts. on sorghum.

The horse, I. P. Roberts (*New York and London: The Macmillan Co., 1905, pp. XL+401, figs. 97*).—In this handbook a history is given of the domesticated breeds of horses in America, chapters on breeding, judging, and educating the horse; the care of horses, stables, sanitation, and paddocks; the line of draft, weight of horses, width of wagon tires, and related questions.

In the appendix are articles on The Breeding of Horses in Canada for Army Use, by J. G. Rutherford; Computing Rations for Farm Animals, by J. L. Stone; a register of the live stock registry associations with the names of the secretaries or editors; and a summary of statistical data of the number and value of horses in the United States as shown by the last census. A detailed index adds to the value of the volume, which, as a whole, embodies the results of many years of experiment and close observation, and will prove of value in connection with the work of agricultural colleges, as well as of interest to general readers.

Blomo feed for horses, J. B. LINDSEY and P. H. SMITH (*Massachusetts Sta. Rpt. 1904, pp. 88–93*).—As shown by the percentage composition, which is given, of dried Blomo feed (a mixture of ground cornstalks, or some similar material, with dried blood and refuse molasses), it contains more protein and decidedly less fat and starchy material than either oats or corn.

When this material was fed with corn and hay in place of oats to 4 horses, the weight of the animals varied slightly from week to week, but they remained in good condition and performed the amount of work required. In a second trial, 6 quarts of Blomo feed was compared with a like amount of oats, the remainder of the ration being made up of 6 quarts of cracked corn and as much hay as seemed needed. On the Blomo feed the 4 horses used made a total gain of 75 pounds in 6 weeks, and a like number on oats of 55 pounds. The work varied from day to day, and the authors find it impossible to say that one ration gave better results than the other.

"It can simply be stated that the horses ate the Blomo ration readily, kept in good condition, and did satisfactory work during the trial. Considerable of the Blomo spoiled on being kept during the warm weather, and it will be necessary for the manufacturers to reduce the moisture content in order to overcome this difficulty. . . . No injurious effect was noted from feeding a considerable quantity of Blomo as a component of the daily ration during a period of 7 months. The horses kept in good condition and did satisfactory work. Owing to a misunderstanding, whereby the Blomo and oats were fed measure for measure instead of weight for weight, it was not possible to directly compare the feeding value of these two feeds."

Digestion experiments with sheep gave the following coefficients of digestibility for Blomo feed: Dry matter, 66.7; protein, 62.7; fat, 15.3; nitrogen-free extract, 76.0; crude fiber, 61.4, and ash, 31.4 per cent. It "contained noticeably less digestible matter than corn or oats, and at the prices usually prevailing the nutritive matter it contains must be regarded as decidedly expensive."

Poultry experiments, W. P. BROOKS, F. R. CHURCH, and S. B. HASKELL (*Massachusetts Sta. Rpt. 1904, pp. 153–156*).—When wheat and corn supplemented by animal meal were compared for egg production it was found that in the winter period, February 3 to March 17, the average egg production on wheat was 43.33 eggs and on corn 38.33 eggs per 100 hens. For the summer period, May 17 to September 30, the average daily egg production per 100 hens was 19.1 eggs on wheat and 20.66 eggs per day on corn. The cost of food per egg in the winter period on the wheat ration was 0.611 ct. and in the summer period 1.657 cts.; similar values for corn were 0.505 ct. and 1.315 cts.

When wheat and corn supplemented by milk albumin and corn oil were compared, the average egg production on wheat in the winter period was 46.33 eggs per day per 100 hens, and on corn 43.25. Similar values for the summer period were on wheat 31 and on corn 30.17. The cost of food per egg for the two periods on wheat was 0.547 and 1.341 cts., and on corn 0.392 ct. and 0.918 ct.

When wheat and rice were compared, milk albumin being used as a source of animal food in both rations, the average daily egg production per 100 hens on wheat in the winter period was 38.13 and on rice 40.75. For the summer period, the corresponding values were 22.5 and 30.17 eggs, respectively. For wheat the cost of feed per egg in the two periods was 0.698 ct. and 1.59 cts. and for rice 1.186 and 2.379 cts.,

respectively. The author states that rice, which contains very little fat, was selected in order to secure data regarding the importance of this constituent in the ration of laying hens.

"The ration including rice this year as last has given one of the most satisfactory egg products obtained. The high cost of this food at the present time seems to preclude its becoming a question of much practical importance whether rice is well or ill suited as a food for egg production. . . .

"The large egg product where rice is prominent among the foods used seems to indicate that fat is less important than has been judged as the result of some of our earlier experiments. Among the various grains, cleaned rice, as put upon our markets, contains least fiber, and rice is known to be the most digestible of all the grains. It is perhaps these peculiarities of this grain which account for its apparent good effect on the egg product."

Poultry report for 1904 (*North Dakota Sta. Rpt. 1904, pt. 1, pp. 169, 170*).—Brief statements are made regarding the number of poultry kept at the station farm, the eggs laid, stock on hand, etc.

A hatching experiment, W. F. BRITTIN (*Rel. Poultry Jour., 12 (1905), No. 2, p. 237*).—The author tested the effects of rations with and without oyster shells on the fertility of eggs hatched in incubators. In his opinion the results show that eggs laid by hens fed no oyster shells hatched about 20 per cent more chicks than the fertile eggs laid by the hens fed oyster shells. Apparently too much lime hardened the egg shells and prevented good hatches.

DAIRY FARMING—DAIRYING.

Feeding trials with cows, J. L. HILLS (*Vermont Sta. Rpt. 1904, pp. 462-511, 547-584*).—Feeding experiments conducted on the same general plan as in previous years (E. S. R., 16, p. 1109) were designed to test the efficiency of a 2-lb. grain ration for cows, to determine the feeding value of dried molasses-beet-pulp, India wheat meal, and hominy feed, and to secure further data on the experimental error involved in feeding trials. The trials extended over 25 weeks and included 53 cows, the individual tests lasting 5 weeks and including from 4 to 14 cows each.

Grain rations of 2, 4, and 8 lbs. were again compared, the results showing an increase in the yield of milk of 8 per cent when the 4-lb. ration replaced the 2-lb. ration, and of 14 per cent when the 8-lb. ration was fed. It is estimated that when the 2 lbs. of grain was fed instead of 4 lbs. the saving in cost of feed was $4.02 and the loss in butter not made was $1.28, and that when 2 lbs. of grain was fed instead of 8 lbs. the saving in cost of feed was $7.57 and the loss of butter was $3.02. Taking into account the value of the skim milk and manure, the figures in the first instance become $4.02 and $3.33, respectively, and in the second instance $7.57 and $7.09. The results in opposition to those obtained last year are therefore favorable to the restricted grain ration. "The writer's judgment, notwithstanding this outcome, does not approve a grain ration so very restricted in its nature."

Dried molasses-beet-pulp was compared with wheat bran, with which, pound for pound of dry matter, it was found to be equivalent in feeding value. A similar comparison was also made with corn silage with like results.

India wheat meal, produced locally from the seed of *Fagopyrum tartaricum*, was compared with wheat bran and a mixture of cotton-seed meal and linseed meal. When fed in small quantities the India wheat meal was considered a fair substitute, pound for pound, for these 2 feeds.

Hominy feed in comparative tests was found equal in value for milk production to wheat bran, but inferior to gluten meal and a mixture of cotton-seed meal and linseed meal. At market prices the hominy feed was not so economical as the gluten and cotton-seed and linseed meals.

When 6 to 8 animals are used in feeding trials by the alternation method there is believed to be practically no experimental error.

A comparison of feeding trial methods, J. L. HILLS (*Vermont Sta. Rpt. 1904, pp. 511–523*).—This gives the results of the fourth test of the 2 methods of conducting feeding trials designated the "simple alternation system" and the "combined continuous and alternation system," the same conclusion being reached as in previous years that the alternation system is the better of the two. While it is not considered likely that material change in this position will result from future trials, it is nevertheless the intention to accumulate additional data on this subject.

Record of the station herd for 1903–4, J. L. HILLS (*Vermont Sta. Rpt. 1904, pp. 523–532*).—Records of 51 cows for the year are reported. Some of the average results are as follows:

Yield of milk 5,018 lbs., fat content 5.07 per cent, total solids 14.42 per cent, yield of butter 296.8 lbs., cost of food $48.11, and proceeds from sale of butter, $89.05. Records of the herd for 10 years have now been obtained, and the commencement of an attempt to digest this mass of data has been made which, it is hoped, may be reported upon in the near future.

Report of dairy department, J. S. MOORE (*Mississippi Sta. Rpt. 1904, pp. 16–22*).—Records of 9 Jersey cows and of 5 native or grade cows for 1 year are reported. The average yield of milk of the Jersey cows was 4,902 lbs. for the year, and of the other cows 3,904 lbs. The average cost of producing 1 lb. of butter in the former case was 7.48 cts. and in the latter 11.9 cts.

In an experiment lasting 4 weeks 4 cows were turned on native pasture and 4 were put on a 3-acre field of hairy vetch. The cows on vetch pasture received in addition cotton-seed hulls and meal, while the other cows received hay, cotton-seed hulls and meal, and wheat bran in addition to the native pasture. The cows fed hairy vetch produced in the 4 weeks 272 lbs. more milk than the other cows. Allowing market values for the feeds consumed and the milk produced, a difference of $15.44 was credited to the 3 acres of hairy vetch. The yield of vetch seed was apparently not decreased by the grazing.

Forage and soiling experiments, 1903, G. C. WATSON and T. I. MAIRS (*Pennsylvania Sta. Rpt. 1904, pp. 170–172, 174–182*).—Ten forage crops were grown during the season and fed to 5 cows, the work being in continuation of experiments previously reported (E. S. R., 15, p. 998). The authors summarize the results obtained as follows:

"(1) Of the various crops grown alfalfa produced the largest yield of air-dry substance per acre. As a green forage this crop was quite satisfactory. The cows ate it with considerable relish, and everything considered it proved a most satisfactory soiling crop. Wherever alfalfa can be grown successfully it is to be recommended for soiling purposes.

"(2) Flat peas produced next to the largest yield of dry matter and also next to the largest yield of total protein. This plant when well established gives a large yield of forage that is rich in protein, but as a soiling crop for dairy cows it is not to be specially recommended for several reasons. It requires two or three years to become well established. It is not relished by cattle and it may impart to the milk an undesirable flavor when not cautiously fed.

"(3) Corn ranks third in a production of air-dry substance, and is one of the best and cheapest of soiling crops. The most serious objection to this crop is due to the fact that its period of maturing is so late in the season that it can not be profitably fed in the fresh condition except in the latter part of the season.

"(4) Sorghum and cowpeas produced a large yield of nitrogenous and palatable food. This combination proved most satisfactory in all respects. The cows ate it readily, and from the feeder's standpoint very few objections were noted.

"(5) Rye is praised as a soiling crop on account of its rapid growth early in the season. A mistake is often made in cutting this crop too late in the season. Cutting should be commenced before the rye heads out. After heads are formed it rapidly becomes woody and unfit as a soiling crop. Under ordinary conditions it can not be fed very long after heading out without causing a decrease in the flow of milk.

"(6) Soja beans and cowpeas produced a fair yield of dry matter per acre and proved quite satisfactory as soiling crops. From the trials made at the station with these two crops, cowpeas are preferred to the beans. The vines are less woody and from the feeder's standpoint are preferred.

"There seems to be quite a marked difference between the different varieties of soja beans. Some varieties mature very much earlier than others. As both soja beans and cowpeas are hot-weather plants and thrive best in warm countries the early maturing varieties should be sown.

"(7) Where Canada field peas grow well they make a most excellent forage crop when sown with oats. It is essential to have the sowing made early in the spring in order to secure a good germination. If the seeding is made late in the spring the peas should be sown somewhat deeper than the oats. This crop produced a good yield and proved to be a most excellent soiling crop. It has the advantage of some other crops of being readily converted into good hay if more is raised than is needed for soiling purposes.

"(8) Rape is not to be commended as a soiling crop. Cattle do not eat it well and in some instances it is said to have imparted an objectionable flavor to the milk. It is not so early as some other crops and neither is it as good."

The feeding value of apple pomace, J. B. LINDSEY (*Massachusetts Sta. Rpt. 1904, pp. 85–87*).—The average composition of 2 samples of apple pomace is reported as follows: Water 80 80 per cent, protein 0.98, fat 1.09, nitrogen-free extract 13.38, crude fiber 3.09, ash 0.67. The average coefficients of digestibility as determined in 6 trials are as follows: Dry matter 71.5, fat 45.3, nitrogen-free extract 84.4, crude fiber 64.4, ash 48.7. Apple pomace is therefore believed to approach corn silage in feeding value.

From 15 to 30 lbs. of apple pomace have been fed daily to dairy animals at the station with satisfactory results. When fed in a balanced ration it is estimated that 4 lbs. of apple pomace is equivalent to 1 lb. of good hay. Feeders are cautioned against feeding too large quantities of apple pomace at first. "Judging from all the data available, it is believed that farmers living in the vicinity of cider mills will find it good economy to utilize the pomace as a food for their dairy stock."

A milking machine that promises to be a success, H. H. LYON (*Hoard's Dairyman, 36 (1905), No. 33, p. 855*).—The author describes briefly and comments favorably upon the use of the Burrell machine.

The composition of cow's milk obtained at one milking from the different quarters of the udder, R. HANNE (*Milchw. Zentbl., 1 (1905), No. 8, pp. 356–363*).—In these experiments with 15 cows the yield of milk from the different quarters of the udder varied greatly. In general the hind quarters yielded more than the fore and the right half more than the left. Marked differences were observed in the composition of the milk from the different quarters at the same milking, and these variations were not constant for any cow in successive milkings.

Investigations on the influence upon milk production of food fat and other food constituents when added to scanty rations, A. MORGEN, C. BEGER, and G. FINGERLING (*Landw. Vers. Stat., 62 (1905), No. 4–5, pp. 251–386*).—This series of experiments, conducted with 8 sheep and 1 goat, is in continuation of similar work previously noted (E. S. R., 16, p. 696). The basal ration fed in the present experiments was normal as regards nutritive ratio but restricted in quantity. In some of the experiments the quantity of fat in the basal ration was also deficient. The food constituent particularly studied as an addition to this ration was fat, though more attention was paid to carbohydrates and protein than in the earlier work.

When fed under these conditions the addition of fat and of protein had always a very favorable influence on milk production, though in an essentially different manner, the food fat being considered as exerting a specific influence on the formation of milk fat, while the protein showed no such specific action. The addition of carbohydrates was without influence on either the total yield of milk or the production of milk fat. The additional quantity of food fat increased the refractometer number of the milk fat. Protein and carbohydrates showed no such influence. The variations in the live weight of the animals due to the supplementary foods was unimportant and warranted no definite conclusions.

While not able to prove that protein and carbohydrates have no specific influence in the production of milk fat, the authors believe from the results obtained in their investigations to date that food fat in quantities appropriate to the individual is especially suited to the formation of milk fat and, perhaps up to a certain limit, can not be generally replaced by the other food constituents. The reliability of the method employed in making corrections for the decreased production of the animals in successive periods is also discussed.

The chemistry of cow's milk, L. L. VAN SLYKE (*Arch. Ped., 22 (1905), No. 7, pp. 509–522*).—This discussion is based largely upon data obtained by the experiment stations in the United States.

"The knowledge thus furnished impresses one with the following facts: First, analyses of milk, either averages or individual, furnish little real information unless we know something of the history of the samples. Second, analyses made in other countries may have little or no value when applied to milk produced in the United States. Third, any statement of so-called average composition of milk is misleading, because normal cow's milk varies so much in composition, while many averages that have been published are entirely misleadiug and thoroughly absurd."

The author considers the nature and amounts of the different constituents in milk, and suggests that in modifying milk for the use of infants and invalids the only way that is really safe is to ascertain the actual content of fat and proteids in the milk to be used for this purpose, rather than to take any average statement of composition as a basis for such modification.

On the origin of lactose, C. PORCHER (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 1, pp. 73–75*).—In continuing his studies on the physiology of the mammary gland (E. S. R., 16, p. 192), the author made use of 4 goats and 1 cow in full lactation, removing the mammary gland in each instance. The results are in accord with those previously obtained, and indicate that the transformation of glucose into lactose is an intramammary function.

The detection and interpretation of the presence of ammonia in milk, A. TRILLAT and SAUTON (*Ann. Inst. Pasteur, 19 (1905), No. 8, pp. 494–502*).—As applied to milk the nitrogen iodid test for ammonia, previously noted (E. S. R., 17, p. 113), is made preferably as follows:

Ten cc. of milk is placed in a test tube and treated with 10 cc. of a 10 per cent solution of iodin trichlorid. The filtrate is neutralized carefully by the addition of lime water, when in the presence of ammonia a black precipitate of nitrogen iodid soluble in an excess of the reagent is formed. According to the authors, as small a quantity of ammonia as 1 in 100,000 may be detected in this way and approximate quantitative determinations made colorimetrically.

The milk of healthy cows was not found to give this reaction. The authors then investigated the conditions under which ammonia may be present in milk. Milk inoculated with sour milk and with typhoid, coli, anthrax, tubercle, and cholera germs did not show the presence of ammonia during 72 hours. On the contrary, milk inoculated with *Micrococcus ureæ, Tyrothrix tenuis, T. filiformis, Bacillus V* of Flügge, sewage, and putrefying materials responded after some hours to the test. So also did pure milk diluted with 10 per cent of water from the Seine River.

While the absence of ammonia is therefore no proof of the purity of a sample, its presence must be considered as an indication that the milk has been watered or otherwise contaminated, and this method of examination therefore becomes of importance from the standpoint of hygiene.

Are nitrates eliminated by the mammary gland? M. HENSEVAL and G. MULLIE (*Rev. Gén. Lait, 4 (1905), No. 22, pp. 512–518*).—The presence of nitrates in milk is usually accepted as an indication of watering.

In endeavoring to ascertain if nitrates are ever excreted in milk, the authors have carried on experiments since 1903 with 20 cows, most of which were diseased. The results with only 1 cow are reported in this preliminary note. This animal, which was affected with actinomycosis, was given potassium nitrate, and the milk obtained showed often, though not uniformly, the characteristic reaction of nitrates.

The fat of top milks, J. W. ENGLAND and C. H. LA WALL (*Jour. Amer. Med. Assoc., 45 (1905), No. 13, pp. 893, 894*).—Fat determinations by the Leffmann and Beam method were made of the layer of cream in certified, guaranteed, and ordinary bottled milk as sold by 8 or 9 dairies in Philadelphia. It is stated that marked differences were found in the fat content of the cream from pint bottles as compared with quart bottles, and for that reason pint bottles should never be used in obtaining top milk for modification in infant feeding.

Biological and biochemical studies of milk, C. J. KONING (*Milchw. Zentbl., 1 (1905), Nos. 7, pp. 289–305; 8, pp. 338–356*).—The studies here reported in continuation of previous work (E. S. R., 16, p. 817) deal with the acidity of milk. Among the conclusions reached are the following:

In market milk there is no definite relation between the number of bacteria and the degree of acidity. The loss of carbon dioxid, through which the acidity is reduced, is not replaced during the bactericidal stage by the production of lactic acid. Not until the degree of acidity has passed a certain limit is there a definite relation between the production of acid and the multiplication of lactic-acid bacteria. If, however, sterilized milk is inoculated with lactic-acid bacteria there is a definite relation between the acidity and the bacterial content.

Infection from the air of the stable is of great influence in the souring of milk. It is not possible to draw conclusions as to the age of a sample of milk from the increase in acidity in a certain time at a definite temperature. In some investigations in Holland the morning's milk contained more bacteria than the evening's milk. Prompt cooling lengthens the bactericidal phase and delays the decomposition of the milk. Cleanliness in milking and low temperatures in keeping milk are essential in delaying souring.

Any particular brand of commercial culture for the ripening of cream was not found to be uniform in chemical composition, and many of the bacteria were found to be dead or incapable of growth.

Does centrifuging lessen the number of bacteria in milk? S. A. SEVERIN (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 18–20, pp. 605–615*).—Counts were made of the number of bacteria in samples of milk taken immediately before and after (1) ordinary centrifugal separatiou, (2) separation with the centrifuge protected with sterilized cotton to prevent entrance of bacteria from the air, and (3) before and after centrifuging or shaking in closed bottles. The interval between the taking of samples was about 15 minutes.

The number of colonies developing on agar and gelatin plates was increased to a marked extent by all three methods of treatment. Contamination from the air during separation or shaking was therefore excluded as a cause of this increase. The explanation offered by Dunbar and Kister that groups or clumps of bacteria which develop as single colonies in the first instance appear as a greater number of colonies on the second series of plates is not accepted by the author, who suggests instead that

the natural process of vegetative division is hastened by the mechanical action, so that bacteria about to become separated are torn apart sooner than would ordinarily occur.

On the effect of heat on cow's milk, O. JENSEN and E. PLATTNER (*Ann. Agr. Suisse, 6 (1905), No. 6, pp. 205–223; Rev. Gén. Lait, 4 (1905), Nos. 16, pp. 361–368; 17, pp. 388–397; 18, pp. 419–424*).—Samples of mixed milk were heated momentarily or for periods of 5, 15, 30, or 60 minutes, or 5 hours, at temperatures ranging from 50 to 140° C., and subjected to chemical examination.

The albumin was partly coagulated at 60° when the heating was prolonged for 5 hours, though the greater part was not precipitated below a temperature of 70–75°. All the albumin was coagulated by heating at 77.5° for 1 hour, 80° for ½ hour, or 90° for 5 minutes. Momentary boiling, provided the milk was brought rapidly to the boiling point and promptly cooled, left traces of albumin in solution.

The casein was coagulated by heating for 30 minutes at 130° or for 5 minutes at 140°. By heating at the latter temperature for 30 minutes a fourth of the casein was transformed into soluble nitrogenous substances nonprecipitable by acetic acid. Changes in the casein, however, occurred at lower temperatures and contributed in producing the browning usually ascribed solely to a caramelization of the lactose.

The degree of acidity was at first reduced by heating on account of the expulsion of carbon dioxid, but at higher temperatures it was increased, which was believed to be due to the decomposition of the casein and the formation of acids rather than to changes in the lactose. The cooked taste was believed to be closely associated with the changes produced in the albumin.

Storch's paraphenylenediamin test gave negative results when applied to milk heated momentarily at 80°, 5 minutes at 75°, 30 minutes at 72.5°, or 5 hours at 70°. The total destruction of the superoxydase, upon which this test depends, occurred, therefore, sooner than the complete coagulation of the albumin. In general Storch's reaction ceased precisely at the point where the cooked taste manifested itself.

Heating increased the time required for the coagulation of milk by rennet gradually up to the point of minimum acidity, at which stage the time required for coagulation increased very abruptly and then remained constant until the heating was sufficient to cause a browning of the casein, when a further marked increase in the time of coagulation was observed. The first of these two critical stages was reached by momentary boiling or by heating for 5 minutes at 80°, 1 hour at 77.5°, or 5 hours at 70°, and the second by heating for 5 minutes at 120° or 30 minutes at 110°.

To determine the cause of this delayed coagulation the authors added milk enzyms in the form of separator slime and also lactalbumin to heated milk without affecting to any marked extent the time required for coagulation. The main alterations in heated milk affecting its coagulation with rennet and occurring at the two stages mentioned are, therefore, believed to be due to changes in the casein molecule. The minor changes as regards coagulation brought about previous to the first critical stage are considered as due to the expulsion of carbon dioxid and probably also to the destruction of natural rennet in the milk and in some cases to the precipitation of lime salts.

The lactose as determined polarimetrically showed a marked reduction as a result of heating above 120°. Gravimetric determinations, however, did not show this reduction. The fat globules showed fusion only when the milk was heated above 120° for short intervals or at 70° for 5 hours.

From the above and other results obtained in these investigations, the authors conclude that in order to preserve the properties of raw milk, which is especially desirable in infant feeding, the heating should not be continued for several hours at 60° nor exceed for a single instant 70°. The temperature should not exceed that necessary for destroying pathogenic bacteria, more particularly the tubercle bacillus,

for which heating for 20 minutes at 60° has been found by T. Smith and 5 minutes at 65° by Bang and Stribolt sufficient when proper precautions are observed. The home pasteurization of milk for infant feeding is recommended.

Experimental investigations on the sterilization of milk with hydrogen peroxid, with special reference to the method of Budde, M. LUKIN (*Centbl. Bakt.* [*etc.*], *2. Abt., 15 (1905), Nos. 1, pp. 20-32; 4-6, pp. 165-174*).—The literature of hydrogen peroxid as a milk preservative is reviewed, and extended experiments are reported, from the results of which the author draws in substance the following conclusions:

Milk can be sterilized by the addition of hydrogen peroxid. In neutral or in weakly alkaline solutions the bactericidal action of hydrogen peroxid is much greater than in acid solutions. Commercial hydrogen peroxid always contains hydrochloric acid, and for that reason such preparations should be neutralized, preferably just before using.

The temperature exerts a great influence on the bactericidal action of hydrogen peroxid, the lower the temperature the weaker the action. Quantitative investigations have shown that for the sterilization of milk at room temperature a much greater quantity of hydrogen peroxid is required than at incubator temperature. The author's experiments have shown that the temperature of 52° C. recommended by Budde is still more favorable, the quantity required for sterilization being at this temperature reduced to a minimum.

The number of bacteria in the milk is of importance in sterilization by hydrogen peroxid. At room and incubator temperatures the quantity required increases with the bacterial content. At 52° this relation is no longer so noticeable.

For the sterilization of milk at the lower temperatures a relatively large quantity of hydrogen peroxid is required—in the author's experiments 0.07 to 1.5 per cent, corresponding to 24.5 to 600 cc. of the 3 per cent solution per liter. This method is not practical, as the milk so treated is too greatly diluted and can not be consumed on account of its disagreeable taste.

The Budde method—addition of hydrogen peroxid with simultaneous heating of the milk to 52°—is practical for both fresh and market milk. The author's results confirm those of Budde that 0.036 per cent or 12 cc. of the 3 per cent solution per liter is sufficient, except when the bacterial content is very high, when 0.05 per cent is required. Hay and coli bacilli and streptococci added to milk in large numbers are completely destroyed by treatment with 0.036 per cent at 52°.

Milk treated by the Budde method contains small quantities of hydrogen peroxid, which is recognizable by taste. The complete removal of the hydrogen peroxid from the milk is desirable from both hygienic and practical standpoints. The author's experiments with blood serum, fibrin, meat, and egg albumin along this line have not given satisfactory results.

The author also presents in conclusion a summary of the principal advantages and disadvantages of the Budde method.

Investigations on the preservation of milk with formalin, H. DE ROTHSCHILD and L. NETTER (*Rev. Hyg. et Méd. Infant., 4 (1905), No. 4, pp. 334-352*).—The authors review the literature of this subject and present the results of experiments with dogs having gastric fistulas. In the proportion of 1:10,000, as recommended by von Behring, formalin is not believed to destroy pathogenic bacteria or prevent the development of all saprophytic species, while it lessens the digestibility of the casein.

In the experiments here reported the digestion of milk treated with formalin in the proportion of 1:2,000 was slower and less complete than that of ordinary milk, while in the proportion of 1:5,000 no differences were appreciable. One of the animals consumed daily for 6 weeks about 500 cc. of milk preserved with formalin in the proportion of 1:2,000 and gained considerable in weight. It is believed to be

erroneous to conclude from these favorable results with animals that formalin is harmless when consumed by human beings, more particularly infants.

The ripening of Hartz cheese, C. H. ECKLES and O. RAHN (*Centbl. Bakt.* [*etc.*], *2. Abt., 14 (1905), No. 22-23, pp. 676-680*).—A chemical and bacteriological study was made of the ripening of this small sour milk cheese. Contrary to generally accepted views, the ripening process was found to be unlike that occurring in soft cheeses.

In the outer portion of the cheese the acidity decreased very rapidly from 2.57 to 0.23 per cent, while in the center it decreased quite gradually for 15 days, being then reduced only to 1.26 per cent. Of the total nitrogen in ripe Hartz cheese 86.2 per cent was in the form of albumoses and peptones, 6.7 amids, 3.5 ammonia, and 3.6 per cent was insoluble, showing a much greater percentage of water-soluble proteids than in Camembert and other kinds of cheese, analyses of which are given for purposes of comparison.

The bacteriological investigations showed that yeast as well as Oidium are concerned in the process of ripening.

Micro-organisms in the cheese industry, P. MAZÉ (*Ann. Inst. Pasteur, 19 (1905), No. 8, pp. 481-493*).—This, the third article of a series on this subject, deals with the changes brought about in the casein of cheese by the action of bacteria and fungi, a number of theoretical and practical conclusions being drawn from the discussion.

Condensed milk, C. D. HOLLEY (*North Dakota Sta. Rpt. 1904, pt. 2, pp. 181-191*).—Information is given regarding the growth of the condensed milk industry and processes of manufacture, together with the results of a number of analyses of different brands of condensed milk and cream. The conclusions based upon the author's observations follow·

"The evaporated creams are not evaporated creams, but simply unsweetened condensed milks. There is a marked lack of uniformity in the composition of unsweetened condensed milks and a tendency to fall below the United States's standards. The sweetened condensed milks are of standard quality and very nearly standard weight. The unsweetened condensed milks were short weight in all cases with a minimum weight of 11.7 oz. and an average of 12.6 oz."

Some observations on milk powder, O. JENSEN (*Rev. Gén. Lait, 4 (1905), No. 23, pp. 538-542*).—Brief notes are given on the Hatmaker and Ekenberg processes of making milk powder, and an analysis of a milk powder made in Switzerland is reported. A liter prepared from 134 gm. of this powder was within the limits of normal milk in composition except as regards soda, which was in excess, due to the addition of the alkali in the process of manufacture.

VETERINARY MEDICINE.

Fungi parasitic on man and animals, F. GUEGUEN (*Les champignons parasites de l'homme et des animaux. Paris: A. Joanin & Co., 1904, pp. XVII + 299, pls. 12*).—This volume contains a monographic account of all fungi known to be parasitic on man and animals, with especial reference to the pathogenic action of these fungi. The material is treated in a systematic manner according to the position of the fungi concerned. Fungi parasitic on man and animals are found in the groups Myxomycetes, Oomycetes, Basidiomycetes, Ascomycetes, and Mucedineæ. Detailed and classified bibliographies are presented at the end of each group of fungi discussed.

Abstracts of work done in the laboratory of veterinary physiology and pharmacology, I, P. A. FISH ET AL. (*Ithaca: N. Y. State Vet. Col., 1904, pp. 53, figs. 19*).—This is the first of a series in which it is proposed to publish abstracts of scientific articles written by the department of veterinary physiology and pharmacology of the New York State Veterinary College.

In the present number an account is given of the use of Echinacea in veterinary practice; the digestive action of bile in some domestic animals; calcium sulphid in the treatment of poll evil and fistulous withers, and the effects of certain drugs upon the blood pressure and cardiac inhibition in the horse. The last-named article has already been abstracted from another source (E. S. R., 15, pp. 118, 119).

In the treatment of poll evil and fistulous withers with calcium sulphid it was found that doses larger than 10 or 15 grains daily tended to increase the discharge and hinder the healing process. A convenient method of administering this drug is in gelatin capsules, and in general no good results can be obtained without a standard quality of the drug.

Annual report veterinary department of station, J. C. ROBERT (*Mississippi Sta. Rpt. 1904, p. 26*).—In vaccinating 305 pure-bred cattle against Texas fever 12, or about 4 per cent, were lost. Several of the animals, however, were too old for successful vaccination. Blackleg vaccine has been distributed with beneficial results.

Treatment of four anemic diseases in domesticated animals by means of artificial hemoglobin, EVERS (*Berlin. Tierärztl. Wchnschr., 1905, No. 11, pp. 201–205*).—The author has carried on a number of experiments with artificial hemoglobin, also known as Damholid, in the treatment of Texas fever, lung-worm disease of sheep, anemia in dogs, and perverted appetite in cattle.

The author has treated 74 cattle for Texas fever by means of hemoglobin with a loss of only 2 animals. In 1904, 31 cattle were treated and all recovered, although 8 of this number were in a hopeless condition before treatment. Similarly satisfactory results were obtained in the treatment of other anemic diseases. The author believes that artificial hemoglobin gives the same beneficial effects when administered by way of the mouth as when inoculated subcutaneously or intravenously. Administration by way of the mouth was therefore preferred when the expense was not too great.

The classification and nomenclature of diseases known under the name actinomycosis, J. LIGNIÈRES and G. SPITZ (*Bul. Soc. Cent. Méd. Vét., 82 (1905), No. 4, pp. 64–93*).—From a study of the organisms obtained in different forms of actinomycosis, with reference to their morphology, biology, and pathogenic properties, the author comes to the conclusion that there are 3 groups of organisms causing 3 distinct diseases which are commonly referred to under the name actinomycosis.

The first group is *Actinomyces bovis*, also known as *Streptothrix actinomyces*. This organism produces the ordinary typical form of actinomycosis in cattle. The second group includes *Streptothrix israeli*, *S. spitzi*, and the species of Streptothrix studied by Doyen. This organism does not produce infection when inoculated intravenously. Positive results, however, are always obtained after subcutaneous inoculation of cattle, sheep, hogs, dogs, rabbits, and various experimental animals.

Actinobacillosis constitutes the third group and is due to actinobacillus. The cultural peculiarities of this organism are described in considerable detail. The bacillus causes serious infection in nearly all species of animals after intravenous inoculation. Subcutaneous inoculation also causes the formation of abscesses in dogs, rabbits, horses, and other animals.

The biology of the micro-organism of actinomycosis, J. H. WRIGHT (*Jour. Med. Research, 13 (1905), No. 4, pp. 349–404, pls. 10*).—The literature relating to actinomycosis is critically discussed in connection with a bibliography of 109 titles.

The author's experiments were made with actinomyces from 13 human and 2 bovine cases. Particular attention was given to a study of the morphology of the micro-organism under various conditions and on different culture media. In inoculation experiments rabbits and guinea pigs were used for the purpose of comparing the effects of bovine and human actinomyces. The results of these inoculations were not constant. Some races of the micro-organism produced relatively extensive lesions, while in other cases the effects were much less pronounced.

An elaborate discussion is presented of the biology of actinomyces. As a result of the author's study it was found that actinomyces grows well only in agar and bouillon cultures and in the incubator. It is essentially anaerobic and does not form spores. In cultures the colonies are smaller in character than those which are obtained from actinomycosis. The author concludes that there is but one species of actinomyces, since no essential difference was found between different races of the organism obtained from human and bovine sources.

Increasing the virulence of human tubercle bacillus up to that of the bovine form, D. A. DE JONG (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 38* (*1905*), *Nos. 2, pp. 146–153; 3, pp. 254–264, figs. 12*).—Some of the recent literature relating to this subject is critically discussed.

The author carried on a number of experiments for the purpose of determining whether it was possible to increase the virulence of human tubercle bacillus so as to equal that of the bovine form. During the experiments reported in the article it was found that the degree of virulence ordinarily possessed by the bovine tubercle bacillus was reached by the human tubercle bacillus after passage through 2 goats, 1 calf, and 2 guinea pigs.

At the end of this period, the race of bacilli, which at the beginning was of comparatively low virulence had become exceedingly virulent, and was capable of destroying laboratory animals with generalized tuberculosis as quickly as the most virulent cultures obtained directly from cattle.

Experimental transmission of tuberculosis from man to cattle, A. EBER (*Ztschr. Fleisch u. Milchhyg., 15* (*1905*), *No. 7, pp. 193–204, pl. 1*).—In the experiments reported in this paper, the author made use of tuberculous material obtained from 5 children which showed tuberculous alterations in the alimentary tract and mesenteric glands.

For the purpose of comparing the virulence of this material with bovine tubercle bacilli, virus was taken from 4 cattle which after slaughter showed evidence of infection with pearl disease. Detailed notes are given on the inoculation experiments carried out with this material. The tuberculous material obtained from children was inoculated into calves 8 to 12 weeks old either directly or after a preliminary passage through guinea pigs.

As a result of these experiments it was found that the virus thus employed was very virulent for 2 calves, moderately virulent for 2 other calves, and slightly virulent for the other 3. The virus obtained from cattle was inoculated into 5 young cattle from 12 weeks to 2 years old. This material proved very virulent for 1 animal, moderately virulent for 2, and only slightly virulent for the other 2. The author interprets the results of his experiments as indicating that a difference between human and bovine tubercle bacilli can not be successfully maintained.

The pathogenesis of tuberculosis, H. VALLÉE (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 13, pp. 568, 569*).—In the experiments reported in this paper 4 calves were allowed to suck a cow affected with tuberculous mammitis at 2 times at intervals of 48 hours. The quantity of milk taken at each time by each calf was about 150 gm. Subsequently the calves obtained all their nourishment from healthy cows or from sterilized milk.

At the end of 5 weeks they were tested and all reacted to tuberculin. Three of the calves on post-mortem examination showed pronounced affection of the mesenteric glands with tuberculosis. In no case was the spleen or liver affected. This experiment is interpreted as indicating that calves may become readily infected with tuberculosis through the alimentary tract.

The frequency of tuberculous affection of the lymphatic glands of the muscles in food animals, STROH (*Ztschr. Fleisch u. Milchhyg., 15* (*1905*), *No. 5, pp. 137–141*).—The author's observations were confined largely to the lymphatic glands of the musculature, in a restricted sense including the prescapular, axillary, knee fold,

and popliteal glands. The percentage of infection of these glands is shown in tabular form, from which it appears that in cases of tuberculosis the prescapular glands are affected in 26 per cent of cattle, 40 per cent of cows, and 52 per cent of hogs. Similar variations were observed with regard to the other glands. Observations on the various cases studied indicate that mammary tuberculosis in cows occurs in 1.74 per cent of cases.

Treatment of bovine tuberculosis by means of the serum of Cuguillère, V. FAURE (*Prog. Vét., n. ser., 18 (1905), No. 1, pp. 7–14*).—According to the author's experience, bovine tuberculosis sufficiently well advanced to be recognized clinically, may be cured by treatment with the serum of Cuguillère. Cures effected by this method were tested by means of tuberculin and by subsequent microscopic examination of the old tuberculous lesions. These tubercles were found to be nonvirulent.

Protective inoculation of cattle against tuberculosis according to von Behring, LORENZ (*Ztschr. Thiermed., 9 (1905), Nos. 1, pp. 1–22; 2, pp. 131–144*).—In order to obtain as extensive and reliable data as possible concerning results of vaccination experiments thus far carried out a circular letter of instructions was sent to 15 official veterinarians in different parts of Germany. The data thus obtained are presented in a tabular form. Attention is called to the fact that while cattle immunized against tuberculosis according to the system of von Behring may subsequently react to tuberculin, this fact was known to von Behring and has been referred to by him in his publications on this subject.

The resisting power to bovine tuberculosis of two cows previously treated with tubercle bacilli of different origin, A. EBER (*Ztschr. Thiermed., 9 (1905), No. 2, pp. 81–130*).—Details connected with the vaccination of cattle against tuberculosis according to the von Behring system are outlined.

As the result of a thorough study of 2 cows treated in this manner it was found that the subcutaneous injection of 1 gm. of tuberculous material from bovine origin produced a swelling the size of a hen's egg at the point of inoculation in the immunized animal. The animal was slaughtered 6¾ months after inoculation, and at this time merely traces of the infection were discovered. In a nonimmunized animal inoculated at the same time and in the same manner much more extensive swelling took place, followed later by the inflammation of the prescapular lymphatic glands, fever, and other evidence of tuberculosis.

Similar results were obtained when immunized and nonimmunized cattle were inoculated with 2 gm. of tubercle bacilli of bovine origin. The resisting power of the immunized animal was much greater.

The reaction curve of tubercle bacilli from different sources in bouillon containing different amounts of glycerin, T. SMITH (*Jour. Med. Research, 13 (1905), No. 4, pp. 405–408*).—The author had already shown that in glycerin bouillon bovine tubercle bacilli change the reaction from acid to alkaline, while similar cultures containing human tubercle bacilli do not become alkaline. In the experiments reported in the present paper it was found that in glycerin-free bouillon growth was quite feeble or absent, while with the addition of glycerin growth became more vigorous, reaching a maximum when the bouillon contained 1 per cent glycerin.

The study of the tolerance of cattle for tuberculin, L. STUBBE and G. MULLIE (*Ann. Méd. Vét., 54 (1905), No. 4, pp. 198–205*).—Statistical data are given regarding the reaction to tuberculin in 578 cattle. In this number 20 showed a reaction within 2 hours, 68 within 4 hours, 135 within 6 hours, while only 23 failed to react after 18 hours. The reaction began within 12 hours in 441 out of 578 cases. The author believes as a result of his observations that the reaction to tuberculin ordinarily takes place within a shorter period than has usually been named by investigators of this subject.

The diseases of the mammary gland of the domestic animals, P. LEBLANC, trans. by J. A. NUNN (*London: Baillière, Tindall & Cox, 1904, pp. XII+111, figs.*

32).—The anatomical structure of the mammary gland of various domesticated animals is discussed and an account is presented of the physiology of secretion. The diseases to which the mammary gland is subject are discussed under the general heads of injuries, acute mastitis, chronic mastitis, and malignant tumors. The injuries studied by the author include contusions, wounds, abrasions, calculi, obstructions, etc. The chronic forms of mastitis discussed by the author are those due to streptococci, botryomycosis, actinomycosis, tuberculosis, etc.

Milk fever and the new treatment of Schmidt and Evers, PEYRONNY (*Rev. Vét.* [*Toulouse*], *30* (*1905*), *No. 2, pp. 81–88*).—The author describes in considerable detail 6 cases of milk fever which were treated by means of air. As a rule, the air was pumped into the four quarters of the udder until this organ was in a tense condition. The result in all cases was very satisfactory. The author believes that the rapid amelioration in these cases, after treatment with air and other successful methods, is not due entirely to the elimination or neutralization of the toxins which presumably cause the disease.

East coast fever, JARVIS (*Natal Agr. Jour. and Min. Rec.*, *8* (*1905*), *No. 2, pp. 138–142*).—In the author's opinion the only remedy which has given satisfactory results in the control of African coast fever is dipping in an arsenical solution. Instances are cited where the ticks were nearly all destroyed as the result of dipping and without excessive expense. On one farm the disease was apparently eradicated by thorough dipping of all cattle. The arsenical solution did not appear to injure the cattle seriously.

Methods adopted in dealing with east coast fever, S. B. WOOLLATT (*Natal. Agr. Jour. and Min. Rec.*, *8* (*1905*), *No. 2, pp. 178–188*).—The symptoms and pathological anatomy of this disease are described in considerable detail. Strict quarantine measures have been adopted in controling the disease, and in some instances cattle have been moved to high grazing ground for the purpose of getting them beyond the reach of infection. This method is of doubtful value, however, since the disease has been known to prevail in altitudes of 5,000 ft.

Some points to be considered in connection with Rhodesian redwater, S. STOCKMAN (*Jour. Compar. Path. and Ther.*, *18* (*1905*), *No. 1, pp. 64–72*).—Immunity toward this disease is not well understood. The confusion of opinion which prevails regarding this matter may be partly due to the fact that the African coast fever has frequently been mistaken for ordinary Texas fever.

It is not absolutely certain that cattle of a truly indigenous race are born immune. It appears certain that the disease is spread by ticks which have fed upon the virulent blood of affected animals. If such cattle pass along a road it may readily become infected, and susceptible cattle must subsequently be kept away from such roads until the infection is destroyed.

Tests of substances for tick destruction, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 26* (*1905*), *No. 3, pp. 387–395*).—During the year 1904 a number of experiments were made in the continuation of an investigation of insecticides for ticks.

In previous years arsenite of soda with or without the addition of soap was found to be a cheap and efficient remedy for the destruction of ticks. In subsequent tests Stockholm tar was added to arsenical dips, but this increased the cost of the dip considerably. Stockholm tar has the advantage of being a good dressing for wounds and of itself is an insecticide of considerable value. The comparative test was made between simple arsenic dips and arsenical solutions containing tar. A tar-arsenic-soap dip was also tested as a tick destroyer.

The last-named dip proved no more efficient than simple solutions of arsenite of soda, although the latter dip contained slightly less arsenic. Arsenical sprays were found not to harm any of the cattle which were used in these tests. The frequent dipping of sheep in arsenical preparations, however, causes considerable injury to the sheep, and unless great care is exercised a heavy mortality.

Serum treatment for infectious diarrhea of calves, P. HEURGREN (*Svensk Vet. Tidskr., 10 (1905), No. 1, pp. 30–33*).—The author made use of Jensen's polyvalent serum in the treatment of 10 calves for the prevention of diarrhea. The disease had appeared in 20 calves on the same estate before this method of vaccination was adopted. All of the treated calves appeared to be rendered immune, since no case developed among them.

Sorghum poisoning, W. R. PERKINS (*Mississippi Sta. Rpt. 1904, pp. 35, 36*).—Hydrocyanic acid was found in the stomach of a cow which died suddenly, and in sorghum from the field where she had grazed. The only plat of sorghum found to contain traces of the acid had made the most luxuriant growth.

Poisoning of cattle from Ranunculus sceleratus, HÖNSCHER (*Ztschr. Veterinärk., 17 (1905), No. 3, pp. 107, 108*).—Cattle fed on wild hay containing *Ranunculus sceleratus* were seriously affected. In a herd of 25 cows, 4 showed evidence of great cerebral excitement and spasms. Two died and exhibited considerable irritation of the gastric mucous membrane.

The occurrence of filaria embryos in horses and cattle, A. E. TEN BROEKE (*Tijdschr. Veeartsenijk., 32 (1905), No. 6, pp. 255–257*).—In horses infested with filaria the appetite was very poor, but the pulse and respiration were almost normal. Edematous swellings were observed in 2 cases. Fowler's solution was administered in large doses without favorable results. Death took place after a few days. Similar results were had in attempts to treat cattle.

Surra and the differentiation of trypanosomiases, A. LAVERAN and F. MESNIL (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 13, pp. 831–836*).—As a result of the study of these diseases the authors recognized several forms occurring in different countries. It appears that there are 3 recognizable forms of surra distinguished by their virulence and occurring in India, Mauritius, and Mbori. The methods which have proved efficacious in the hands of the authors in the differentiation of trypanosomiases may be used in distinguishing these forms of surra.

The tsetse-fly disease and immunization of domesticated animals, E. MARTINI (*Ztschr. Hyg. u. Infectionskrank., 50 (1905), No. 1, pp. 1–96, pls. 2, figs. 17*).—The morphology and biology of the trypanosome of tsetse-fly disease is discussed in great detail in connection with a series of experiments carried out by the author.

Numerous tests were made in passing the trypanosomes through various animals by means of inoculation. As a result of these experiments it was found that 2 races of blood parasites of this disease may be recognized according to their different virulence. One race proved to be fatal for the horse, ass, dog, cat, hog, goat, rabbit, etc., after subcutaneous, intraperitoneal, or intravenous inoculation.

Evidence was obtained that horses may carry the blood parasites for years and remain in good health. Some difference of opinion prevails, however, regarding the nature of this apparent immunity and its duration. A healthy animal carrying blood parasites of low virulence may not be immune, however, to blood parasites of another race.

Report on dourine in different breeds of equines, A. LINGARD (*Calcutta: Supt. Govt. Printing, India, 1905, pp. V+84+XCIX, pls. 16*).—In this volume the author presents an elaborate account of his experiments on dourine in India, together with an account of vesicular exanthema and piroplasmosis which in certain cases occurred as complications.

The volume includes a general discussion on the nature of dourine, clinical notes on a large number of spontaneous and inoculation cases, the period of incubation, eruption of plaques, the biology of the blood parasite, symptoms, diagnosis and course of the disease, and susceptibility of different animals. It was found that whenever a cutaneous plaque appears during the course of the disease the pathogenic trypanosoma is present at that point in one or more of its developmental forms.

The blood parasite persists in the plaques as long as edema is to be observed. The developmental forms of the organism are also found in the cerebro-spinal fluid, vaginal mucus, and semen. In a number of cases a mild vesicular exanthema occurred as a complication of dourine and gave rise to a high fever and emaciation in acute cases, with occasional death.

The experimental diagnosis of glanders, G. MAZZINI and A. AGUZZI (*Gior. R. Soc. ed. Accad. Vet. Ital., 54 (1905), Nos. 1, pp. 4–9; 2, pp. 25–38*).—As a result of the authors' study of glanders and the various methods of diagnosing this disease, it is concluded that negative results obtained from the inoculation of guinea pigs, with the mucus of suspected animals, does not permit of drawing the conclusion that the horse in question is not affected with glanders. It was found during these experiments that glycerin exercises a considerable antiseptic action upon the glanders bacillus.

The differential diagnostic value of glanders agglutination in the important internal diseases of the horse, R. LANGER (*Monatsh. Prakt. Tierheilk., 16 (1905), No. 6, pp. 241–254*).—The author's observations were made on 100 horses, some of which were healthy while others were affected with various diseases such as pneumonia, contagious coryza, hemoglobinuria, anthrax, tetanus, influenza, pseudoleukemia, glanders, etc.

Careful tests were made to determine the agglutinative power of the sera of all these cases toward the glanders bacillus. Results of these tests are presented in a table from which it appears that the agglutinative power of healthy horses or horses affected with diseases other than glanders is never greater than 1:500, while the agglutinative ratio of serum from glanderous horses varies from 1:2,000 to 1:5,000.

The author concludes, therefore, that the method of agglutination is perfectly reliable in the diagnosis of glanders. The literature of this subject is discussed in connection with a short bibliography.

Post-mortem diagnosis of glanders, BRETON and CHENEAU (*Rec. Méd. Vét., 82 (1905), No. 3, pp. 81–83*).—As a result of a study of the pathological lesions observed in glanders the conclusion is reached that judgment should not be pronounced too rashly if, in the examination of the lung of a horse, nodular lesions are found which resemble those of glanders. If the anterior portion of the respiratory tract is free from ulcers or old cicatrices, it is necessary to resort to microscopic study in order to determine the specific nature of the organisms concerned.

The prophylaxis of glanders, J. MCFADYEAN (*Jour. Compar. Path. and Ther., 18 (1905), No. 1, pp. 23–30*).—In this article the author reviews the present status of glanders in London, with notes on the extent of the disease, methods of dissemination, and suitable prophylactic measures.

Existing regulations are considered somewhat defective for the reason that the value of mallein is not recognized and that horses exposed to infection are not watched in a sufficiently careful manner. Attention is called to the fact that during the last 12 years from 800 to 2,000 glanderous horses have been annually slaughtered by knackers in London. Not a single case of infection among man has occurred in these establishments. This is considered as indicating that the blood and meat of glanderous horses seldom carry infection.

Mallein as a curative agent in the treatment of glanders, T. E. CARROLL (*West. Vet., 1 (1905), No. 3, pp. 9,10*).—The author's experience with glanders was had in the Philippine Islands, where glanders prevailed extensively at the time when the observations were made. Mallein was tested in a large number of horses and it was found that the temperature reaction took place up to the fourth or fifth injection. In some cases the third temperature reaction was higher than the second. In these tests mallein proved to be a reliable diagnostic agent but no improvement was noted

in any case as the result of its use and no evidence was obtained that it has a curative effect.

The internal administration of formaldehyde by intravenous injection, H. LOMAS (*Vet. Rec., 17 (1905), No. 866, pp. 498, 499*).—Formaldehyde was used in intravenous injections in the treatment of 3 cases of morbus maculosus in horses. In 2 of these cases the dose was 1 dr. in 20 dr. of distilled water, while in the third case the same dose was given in 5 dr. of distilled water. The results were perfectly satisfactory in all 3 cases, 2 of which the author did not expect to recover.

Vaccination for swine erysipelas, SCHNITKI (*Berlin. Tierärztl. Wchnschr., 1905, No. 10, pp. 189, 190*).—During the year 1904 the author vaccinated nearly 6,000 swine for the purpose of protecting them against swine erysipelas. The method adopted was that of simultaneous injection of serum and cultures in different parts of the body. Nearly 4,000 of the hogs received a second injection of virus. No case of swine erysipelas developed as the result of vaccination and only a few cases were observed in the vaccinated herds as the result of subsequent infection.

The histological diagnosis of rabies, F. ABBA and A. BORMANS (*Ann. Inst. Pasteur, 19 (1905), No. 1, pp. 49–61, pl. 1*).—The literature relating to rabies is discussed in connection with a short bibliography. Particular attention is given to the statements of Negri regarding the discovery of the pathogenic organism of rabies. Contrary to the claims of Negri the authors found that the medulla oblongata contains as virulent a virus as is to be found in Ammon's horn. Osmic acid was found to be perfectly reliable in the diagnosis of glanders in one-half of the cases if applied within 24 hours after death.

The symptoms and prevention of experimental rabies, D. KONRADI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 2, pp. 194–199*).—In the experiments reported in this paper rabbits were inoculated in the legs and face and subsequently subjected to various forms of treatment.

In general the incubation period varied between 174 and 570 days. The great length of the incubation period was apparently due to the small quantity of virus used in inoculation. The author concludes from his experiments that infection may be prevented by local antiseptic treatment. Such local treatment must follow within 12 minutes if inoculation was made in the legs and within 3 minutes if the virus is inoculated into the face. It appears that rabies may recur like other infectious diseases.

Antirabies serum, A. MARIE (*Ann. Inst. Pasteur, 19 (1905), No. 1, pp. 1–8*).—It has been observed that when suitable quantities of serum obtained from vaccinated mammals and an emulsion of rabies virus are mixed the 2 substances neutralize each other.

The author carried out a number of experiments for the purpose of testing this process more accurately and for obtaining data concerning the application of the method in the treatment of rabies. It was found during these experiments that the serum obtained from vaccinated animals is not active toward the virus of rabies except after a long preliminary treatment. The serum of untreated mammals appears not to have any power of neutralizing fixed rabies virus. There is no such power to be observed even in the serum of birds, which are naturally immune to the disease.

The action of the neutralizing serum when obtained is specific, but in many cases is confined within very narrow limits. The specific substance combines with the virus of rabies.

Infection and immunity in fowl cholera, E. WEIL (*Arch. Hyg., 52 (1905), No. 3–4, pp. 412–432*).—Attention is called to the many failures which have been experienced by different investigators in devising a successful scheme of vaccination against fowl cholera.

The bacillus of the disease multiplies with such great rapidity that death results within a short time unless the growth of the bacteria is checked. In the author's experiments rabbits were used for producing an exudate which was later used in vaccination. It was found that when the bacilli of fowl cholera in bouillon cultures were inoculated into the pleural cavity of rabbits, death took place within 5 to 8 hours. The quantity of exudate produced in the pleural cavity varies greatly in the different cases but, as a rule, is greatest when small quantities of bacteria are used for inoculation.

In one rabbit, which received 1 drop of a bouillon culture, 27 cc. of exudate was produced in the thoracic cavity. The great rapidity of multiplication of bacteria is apparent from the fact that death may result inside of 5 hours. The exudate produced in the manner just described in rabbits was found to be exceedingly virulent for experimental animals. The exudate was sterilized and used in vaccination experiments with rabbits, chickens, and pigeons. It was found possible to immunize all these animals against the most virulent cultures of fowl cholera bacilli. Even pigeons, which are normally very susceptible to this organism, were immunized by 3 injections of sterilized exudate from rabbits.

Immunization of rabbits against fowl cholera, J. C. Delfino (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 2, pp. 231, 232*).—In the author's experiments Lignière's vaccine was used.

The protective treatment included 2 inoculations with an interval of 10 days. Within 10 days after the second inoculation the animal appeared to be perfectly immune. The author concludes that Lignière's method of vaccination against septicemia of birds in rabbits produces a permanent immunity which is capable of resisting enormous quantities of virulent cultures.

RURAL ENGINEERING.

Irrigation investigations on the North Platte River in 1904, B. P. Fleming (*Wyoming Sta. Bul. 66, pp. 24, figs. 4*).—These investigations included measurements of the duty of water and on the loss from canals by seepage in the Mitchell district on the North Platte near the Wyoming-Nebraska line.

"As measured at the headgate, the amount of water used on a sandy soil containing gypsum is about 5.2 acre-feet per acre, when the acreage actually watered is considered and not the acreage assessed. For an open, sandy soil the amount used is much greater, being about 11.9 acre-feet per acre. These figures are from canals irrigating lands upon which alfalfa is the crop most generally grown.

"As measured on an individual farm, alfalfa requires about 4.5 acre-feet per acre and native hay about 3, the land upon which both were grown having considerable, though not excessive, slope and consisting largely of sand and gypsum.

"For a canal with one or more canals above it the gain in flow, due to seepage from the canals above, may exceed considerably the loss from itself. For a high-line canal, in which the alignment is good, gullies are crossed by one bank on the lower side, and the soil sandy, with gypsum, the average loss to be expected may be about 1.2 per cent of the flow per mile, or 0.10 cubic foot per second per 10,000 square feet of wetted perimeter."

Memoranda of plans for irrigation investigations (*Utah Sta. Circ. 4, pp. 21, figs. 2*).—This circular contains detailed instructions and regulations for the guidance, during the whole growing season, of all connected with the cooperative investigations to be carried on in Utah during 1905. These include plat and pot experiments relative to the effects upon various crops of different total depths of water applied in irrigation, different times of irrigation, and different systems of cultivation.

A crosscut excavating machine for drainage ditches (*Engin. News, 54 (1905), No. 10, p. 250, fig. 1*).—This is an illustrated description of a new type of self-propelling excavator, with the peculiarity that the cutting is done by buckets moving transversely to the line of the canal, on a steel guide frame or template of such shape and proportions that the buckets give at once the desired finished shape to the bank of the canal.

"With a ditch 16 ft. wide on the bottom, and 6 ft. deep, having side slopes of 1 to 1, the machine frequently cut 180 lin. ft. in less than ten hours, the machine being subject to ordinary delays. This is equivalent to between 800 and 900 cu. yds., and was accomplished with the consumption of not more than a ton of coal. This machine weighed 30 tons and had a vertical boiler and a 20 H. P. engine with cylinders 7 by 10 ins., operating two buckets of 1¾ cu. yds. capacity. The only labor required comprised the engineman and fireman on the machine, and one man with team to attend to the laying of the track. . . .

"Among the advantages claimed for this new machine are a reduction in power and labor as compared with a dipper dredge of the same capacity, while the banks are left with the proper slope and in better condition to prevent slides and to give the full capacity of flow for the channel."

Contribution to the biochemistry of sewage purifiation: The bacteriolysis of peptones and nitrates, S. DEM. GAGE (*Technol. Quart., 18 (1905), No. 1, pp. 5–39*).—This article reviews the literature of the subject of the biochemistry of sewage purification, giving a bibliography containing 113 references, and reports experimental data obtained in investigations made at the Lawrence Experiment Station on the processes of ammonification, denitrification, nitrate production, a reduction of nitrates to ammonia, distribution of ammonifying and denitrifying bacteria in sewage and sewage effluents, and on the relation of peptonization to other biochemical functions.

Studies were made of the behavior of 30 pure cultures of bacteria common in sewage and sewage effluents in two solutions (1) 0.1 per cent Witte's peptone solution containing about 14 parts of organic nitrogen per 100,000, and (2) 0.1 per cent of Witte's peptone in distilled water, diluted to three different strengths at different periods of the investigation, and containing nitrogen as potassium nitrate equivalent to 2.7, 6, and 22.5 parts per 100,000. The methods of chemical analysis used are described.

Summarizing the results, the author states that the problem of sewage purification is mainly a question of the bacteria which transform (render innocuous) the nitrogenous matter.

"From the results obtained in this study it becomes possible to state definitely that bacteria common in sewage purification are able to produce ammonia from organic matter, to reduce nitrates to nitrites, to ammonia, and probably to elementary nitrogen, to liberate nitrogen from solutions of organic matter either with or without the presence of nitrates or their reduction products, and also to fix atmospheric nitrogen under the same conditions—all of which reactions have been noted by other observers, but about which there has been more or less controversy.

"Many sewage bacteria probably also produce the lower oxids of nitrogen as reduction products of nitrates, which oxids may play an important part in the further decomposition of the organic matter in solution, either through catalytic action or by direct chemical reaction. Furthermore, certain of these bacteria may perhaps produce an oxid, or at least a compound of nitrogen intermediate between nitrates and nitrites, which has apparently not been noted hitherto.

"The amount of ammonia produced by the different cultures has ranged from none to 18 parts per 100,000, and the rate of ammonification has varied considerably, some of the cultures reacting as early as the fourth day, while other cultures, which

eventually reacted strongly, did not begin to ammonify until after periods of 10 to 14 days. Similar phenomena have been noted with regard to the reaction of the cultures on nitrates."

The behavior of the different cultures was very variable both as regards rate of action and character and proportions of the reduction products.

"Regarding the distribution of ammonifying and denitrifying bacteria in sewage and the effluents from sewage filters, based on a study of the biochemical functions of over 300 representative cultures from a variety of samples, it may be said that a majority of the bacteria from these sources, which are determinable by the ordinary plate methods, using gelatin as a culture medium, reduce nitrates and decompose peptone into ammonia, although these two functions are not always present in the same species. By the use of quantitative tests for the amount of liquefaction produced in gelatin by over 150 of these cultures, we have been able to determine approximately the relation between the peptonizing power, or power to liquefy insoluble organic matter, and the ammonifying and denitrifying powers of sewage bacteria.

"We find that while many nonliquefying bacteria are able to reduce nitrates or to ammonify peptone or to do both, and many liquefying bacteria do not possess these functions, nevertheless, in a large majority of cases, the possession of the first function means possession of one and usually both of the last two functions, and the average amount of change produced in the nitrogenous matter in solution is much greater with peptonizing bacteria than with those which are unable to liquefy gelatin. Furthermore, an increase in the liquefying power appears, as a rule, to be correlated with increased ability to reduce nitrates and to ammonify peptone."

Contribution to the biochemistry of sewage purification; the bacteriolysis of peptones and nitrates, S. DEM. GAGE (*Jour. Amer. Chem. Soc., 27 (1905), No. 4, pp. 327-363*).—Substantially the same article as that noted above.

The effect of water on rock powders, A. S. CUSHMAN (*U. S. Dept. Agr., Bur. Chem. Bul. 92, pp. 24, pls. 4*).—A discussion of this subject, based upon some studies in the Division of Tests of the Bureau of Chemistry on the cementing value of various rock samples when ground wet and dry and on the color reaction with phenolphthalein of the wet-ground material, as well as upon the work of other investigators along the same line. The conclusions reached are as follows:

"(1) The effect of wet grinding is to increase the binding power or cementing value of rock powders, and there are indications that the addition of small amounts of suitable electrolytes to the water will still further increase the action.

"(2) When water comes in contact with most rock powders immediate reactions take place, which are to a certain extent analogous to those which take place with cement and powdered glass.

"(3) These reactions are shown by the alkalinity indicated by phenolphthalein, but this alkalinity is to a great degree inhibited if the solid particles are filtered out.

"(4) The microscope reveals an accumulation of amorphous material of a gummy appearance largely associated with the surfaces of the crystalline particles as the action of water proceeds.

"(5) Evidence is given to show that the basic ions set free associate themselves to a certain degree with the solid particles, leading to a concentration of the acid ions in the clear solution.

"(6) It is shown that the behavior of rock powders after being acted on by water is similar to that of coagulated colloids artificially prepared in the laboratory, and that the formation of colloids upon the surfaces of the particles would account for the increased binding power under the action of wet grinding. The word 'pectoid' is recommended to describe the condition of the particles as being more appropriate to the connection in which it is used than the words 'colloid' or 'hydrogel.'

"(7) The absorption of the bases known to take place when certain clays are treated with dilute salt solutions is explained by means of the colloid theory, as is also their increase of binding power under the action of water and certain solutions.

"(8) The possibility of rendering the potash contained in rocks available as a fertilizer is suggested."

The construction of silos, W. J. FRASER (*Illinois Sta. Bul. 102, pp. 41, figs. 34*).—This bulletin discusses the location, form, proportions, and capacity of silos, and gives a complete account of the cost and construction of a round wood silo plastered with cement, which was 20 feet in diameter and 34.5 feet deep, holding 228 tons, and which cost $383, or $1.68 per ton capacity. A brief description with illustrations is given of concrete, brick, stone, and stave silos.

Use of alcohol as a motive power and its production from farm crops, M. J. R. DUNSTAN (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 26–37*).—This is a discussion of the production and use of denaturized alcohol on the Continent, and of the probable profits to the farmer which would result from a similar use in England.

The author finds that "2 tons of sugar beet will produce 22 gals. of alcohol, the ale prices of which will be about 25s., and 2 tons of pulp at a value of 5s. per ton, so that the farmer and the manufacturer will have about 35s. to divide. The cost of production is about 4d. per gallon. A deduction of 7s. 6d. must therefore be made to arrive at the price the farmer will receive, or 27s. 6d. for two tons of beet. Taking 12s. per ton as an average figure, and allowing thirteen tons per acre as an average crop we get £8 19s. per acre as the value of the beet crop for alcohol production. "Turning now to the case of potatoes, 1 ton of potatoes will produce 22 gallons of alcohol and about 1 ton of pulp, or a value of 30s. to be divided between farmer and manufacturer. Taking off 9s. for manufacture, 21s. is left for the ton of potatoes, or on a yield or 9 tons per acre £9 9s. for all expenses of growing the crop.'

Analysis of lignite coal, E. F. LADD (*North Dakota Sta. Rpt. 1905, pt. 1, p. 30*).—This sample of a briquette, prepared for household use, "was in excellent condition for use."

RURAL ECONOMICS.

Agricultural economics, H. C. TAYLOR (*New York: The Macmillan Co., 1905, pp. VIII+327, figs. 7*).—This book is a study in the economic problems involved in modern commercial agriculture.

The subject is viewed primarily from the standpoint of the farmer, whose aim it is to secure the largest net profit in return for the time and energy which he devotes to agriculture. Some attention is given also to the problems with which the statesman must deal when he attempts to pass laws regulating the conditions under which agricultural operations and transactions are carried on.

The principal subjects discussed are: (1) The factors of production, including the quantity and the character of the supply of land, capital-goods, and laborers in the United States. (2) The principle to be followed in the organization of the farm, and more specifically in the selection of land, the selection of crops, and the selection of farm animals and other forms of capital-goods. (3) The size of farms and the intensity of culture. (4) The prices of agricultural products. (5) The rent of farm land and the profits of the farmer. (6) The principles to be followed in estimating the value of farm land and equipments. (7) The farmer's means of acquiring land, including a discussion of free land, gift and inheritance, savings, credit, taxation of mortgages, and the need of a better system of obtaining credit on land. (8) Tenancy and land ownership in the United States, including a discussion of the decline in the percentage of land-owning farmers, land values and land ownership, land ownership and tenancy among the negroes, the ownership of rented farms, and the relations between landlords and tenants in the United States. (9) The adjustment of the relations between landlords and tenants in England.

Agricultural cooperation in England, E. DRUCE (*Agr. Students' Gaz., n. ser. vol. 12 (1905), No. 3, pp. 89–93*).—This article discusses cooperation in agriculture, from three standpoints: (1) The purchase of requirements, including machinery, (2) the sale of produce, and (3) the establishment of agricultural credit banks.

It is believed that the cooperative purchase of machines for cooperative use may be very desirable in communities of small farmers, but that there is little occasion for such cooperation among large farmers. The cooperative purchase of animals is spoken of as a field in which cooperation may be extended to advantage. Horse societies are mentioned. Cooperation in the sale of products is not thought to be profitable for the better farmers. It is thought that such cooperation tends to level prices and that the tendency is for the lower level and not the higher level to be reached by this process.

It is believed that the more intelligent and energetic farmers can always secure a higher price than can the cooperative society. This is thought to be especially true in a country like England, where a dense population makes it possible for the majority of the farmers to sell their products directly to the retail dealers. The writer does not seem favorably disposed toward the agricultural credit banks. In general, it may be said that this paper represents the attitude of the conservative English farmer on the subject of agricultural cooperation.

Wages, earnings, and conditions of employment of agricultural laborers in the United Kingdom, second report, W. FOX (*London: Bd. of Trade, Labor Dept., 1905, pp. XII + 263, figs. 3*).—This report deals with the systems of engagement, the rates of wages, and the cost of living of farm laborers in the United Kingdom.

In Scotland, Wales, the north of England, and the north of Ireland most of the farm servants are employed by the year, board and lodging being usually provided free in the farmhouses for the unmarried men, and cottages in many districts for the married men. In southern England and southern Ireland laborers are usually employed by the week, and it is very rare for them to be lodged or boarded in the farmhouses.

In 1902 the average rate of wages was 19s. 5d. in Scotland, 17s. 7d. in Wales, 17s. 5d. in England, and 10s. 9d. in Ireland. Between 1898 and 1902 the average rate of wages increased 6.9 per cent in Scotland, 6.6 per cent in Wales, 5.7 per cent in Ireland, and 4 per cent in England.

It is shown by means of a map that throughout the United Kingdom the wages of agricultural laborers were higher near the large industrial and mining centers than in the purely agricultural district. The average weekly value of food consumed by the agricultural laborers, including articles purchased and those produced at home, was 15s. 2½d in Scotland, 13s. 6½d. in England, and 10s. 5¾d. in Ireland.

The economic cost of slaveholding in the cotton belt, U. B. PHILLIPS (*Polit. Sci. Quart., 20 (1905), No. 2, pp. 257–275*).—This article is based upon a study of slave prices. It deals with the general economic conditions of slaveholding, and shows the great transformation caused by the opening of the cotton belt and the closing of the African slave trade.

"From the economic point of view the American system of slavery was a system of firmly controlling the unintelligent negro laborers and of capitalizing the prospective value of the labor of each workman for the whole period of his life." Prior to the invention of the cotton gin, slavery was confined to the lowlands, but the increase in the production of upland cotton after Whitney's invention came into use resulted in the rapid opening of the inland cotton belt. This increased demand for laborers resulted in a rapid increase in the price of slaves.

Between 1800 and 1860 the price of slaves in terms of pounds of cotton increased from 1,000 to 1,200 per cent. With the rise in slave prices slavery became burdensome, because of the enormous amount of wealth which had to be locked up in the purchase of the labor supply. This investment of large sums of money in the capital

value of slaves was all the more burdensome because of fluctuations in cotton prices, for it was the value of cotton which determined the value of slave labor.

"In the great system of southern industry and commerce, working with seeming smoothness, the negro laborers were inefficient in spite of discipline, and slavery was an obstacle to all progress. . . . The capitalization of labor and the export of earnings in exchange for more workmen, always of a low degree of efficiency, together with the extreme lack of versatility, deprived the South of the natural advantage which the cotton monopoly should have given. To be rid of the capitalization of labor as a part of the slaveholding system was a great requisite for the material progress of the South."

Woolgrowing and the tariff since 1890, C. W. WRIGHT (*Quart. Jour. Econ., 19 (1905), No. 4, pp. 610-647*).—This article is a discussion of the competitors of the woolgrowers of the United States, and the effectiveness of protective tariff in sustaining the woolgrowing industry in the United States.

The principal competitors from the outside are Australasia and Argentina. The principal facts to be kept in mind regarding the tariff history of the last 15 years are the Wilson Bill of August 1, 1894, which put wool and woolens on the free list, and the Dingley Bill of July 24, 1897, which restored the duty on wool and woolens. The price of wool produced in the United States is much higher than it would be without protection, yet this difference lacks about 2 cents on the pound of being equal in amount to the tariff. This is due to the difference between the quality of imported wool and that purchased at home.

But imported wool is by no means the only competitive element affecting the wool industry of the United States. The sheep industry must compete with the cattle industry in the grazing districts, with the dairy industry in the East, and with the production of wheat, corn, and hogs in the Central States. In the Rocky Mountain States the sheep industry continued to expand during the period of free trade in wool, but increased very much more rapidly after the duty on wool was restored by the Dingley Bill of 1897.

In the Central and Eastern States wool production declined rapidly after the removal of the duty on wool and even failed to respond to the Dingley Bill. Other products proved more profitable than wool. Where the dairy industry or grain production did not drive out the sheep industry east of the 100th meridian, mutton production took the place of wool production as the chief aim in sheep husbandry.

"General agricultural conditions have been the determining factors in the course actually taken by this industry. The tariff, though not vain, has failed of the end desired. Inadequate for the task imposed, it was defeated by superior powers.

"For the future, the tendencies point to a decline in sheep-raising as an independent industry mainly for wool. Mutton will increasingly dominate the situation, and wool become secondary. In the East, where sheep promise to be incidental to general farming, and wool incidental to mutton, the basis of the industry will be such that the tariff can be of but comparatively slight importance. In the West, which offers sheep-raising far better prospects and a more independent basis, protection can do much more for the woolgrower. Here the competition of the foreign grower is likely to become a more serious factor. . . .

"In the United States the conditions are such as to render a further advance in woolgrowing highly improbable and a gradual decline likely. The power to prevent this, as experience shows, is not to be found in the present tariff." If the woolgrower is to prosper "he must have a duty that will not only enable him to compete with foreign wool, but one that will make his industry at least as profitable as any other that might be carried on in its place—only thus can his flocks be maintained. Yet even then there remain the many forms of competition which operate upon the market for wool so as to lessen the demand. Here the power of the tariff ends. Against these, duties are of slight avail; and whether the industry would thrive in spite of this only experience could tell."

Return of prices of certain classes of Irish agricultural products and live stock (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1904, pp. 51, dgms. 18*).—This report gives the prices of certain agricultural products and live stock in Ireland during the year 1904, with comparative tables for preceding years since 1885. Statistics are given for the following products: Wheat, oats, barley, potatoes, hay, rye, grass seed, flax, cattle, sheep, wool, mutton, beef, pork, eggs, and butter. The figures show great fluctuations in the prices from month to month as well as in the average prices from year to year

AGRICULTURAL EDUCATION.

Agricultural instruction for adults in the British Empire, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 155, pp. 96*).—This is a report by the farmers' institute specialist of this Office on the methods that have been adopted by the various governments included in the British Empire in the dissemination of agricultural information among their rural populations.

The author states that the conclusion reached years ago by Great Britain's wisest statesmen was that the only solution of the question of improving agriculture sufficiently to enable those who pursue it as a calling to maintain themselves in comfort and at the same time to produce a surplus sufficient for the use of those engaged in other occupations lies in their proper education. Accordingly the Government established schools and colleges of agriculture at home many years ago, and has since encouraged their erection in all of her dependencies, until now agricultural instruction in some form or other is given in almost every country under British rule.

The present bulletin describes the means adopted for reaching rural adults through itinerant teachers, traveling schools, farmers' institutes, and other forms of college and university extension. There is also some discussion of the higher institutions which are associated in the work of instruction of adult farmers.

Reading-course bulletins for farmers and farmers' wives (*Albany: N. Y. Dept. Agr., 1904, pp. 788, figs. 404*).—This is a reprint of all the Cornell reading-course bulletins for farmers and farmers' wives up to March, 1905.

The following subjects are treated in the reading course for farmers: (1) The soil—what it is; (2) tilliage and underdrainage—reasons why; (3) fertility of the soil—what it is; (4) how the plant gets its food from the soil; (5) how the plant gets its food from the air; (6) balanced rations for stock; (7) the computing of balanced rations; (8) sample rations for milch cows; (9) soiling crops, silage, and roots; (10) pastures and meadows; (11) how a fruit tree grows; (12) planting the orchard; (13) tilling and fertilizing the orchard; (14) pruning and spraying fruit trees; (15) picking, storing, and marketing fruit; (16) building poultry houses; (17) feeding of laying hens—the principles; (18) rations for poultry; (19) raising chickens; (20) marketing poultry products; (21) the care of milk on the farm; (22) the composition of milk and cream and their by-products; (23) construction of sanitary dairy stables; (24) farm butter making; (25) the dairy herd.

In the reading course for farmers' wives the following subjects are treated: (1) Saving steps; (2) decoration in the farm home; (3) practical housekeeping; (4) the kitchen garden; (5) flowers and the flower garden; (6) the rural school and the farm home; (7) boys and girls on the farm; (8) reading in the farm home; (9) farm home industries; (10) insect pests of house and garden; (11) suggestions on home sanitation; (12) germ life in the farm home—a second talk on sanitation; (13) brief discussion of human nutrition; (14) food for the farmer's family; (15) saving strength.

Agricultural college extension, University of Illinois ([*Circs.*] *March, 1904–July, 1905*).—Among these circulars the following are designed for use in connection with agricultural instruction or the encouragement of interest in farm operations:

Soil fertility experiments, C. G. Hopkins (pp. 8, figs. 6).—This contains explicit instructions for the direction of young people's experimental clubs and public school

pupils in agriculture in conducting pot and plat experiments with commercial fertilizers. The circular also contains a brief discussion of nitrogen-gathering bacteria in their relation to the growth of red clover and other legumes.

Some facts about sugar beets and how to grow them, F. H. Rankin (pp. 8, fig. 1).—Cultural suggestions are given for members of boys' experiment clubs who undertake experiments with sugar beets in cooperation with the College of Agriculture of the University of Illinois.

Reading course in soil fertility, C. G. Hopkins (pp. 4, fig. 1).—A suggestive outline of readings from publications of the agricultural experiment stations and this Department for farmers and instructors in agriculture in public schools.

Studies of corn and its uses, F. H. Rankin (pp. 40, figs. 8).—After explaining the purpose of the agricultural college extension work among the young people of Illinois, the author takes up the following studies: (1) Studies of the corn plant; (2) studies of an ear of corn; (3) the corn score card, (4) studies of the different parts of a kernel of corn; (5) commercial products of corn, and (6) suggestions for corn experiments. Suggestive blanks are given for scoring corn and for keeping corn records.

Testing milk on the farm, C. C. Hayden (pp. 8, figs. 3).—Suggestions and directions for members of young people's experimental clubs and pupils in agriculture in public schools.

Proceedings of the eighteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations, edited by A. C. TRUE, W. H. BEAL, and H. C. WHITE (*U. S. Dept. Agr., Office Expt. Stas. Bul. 153, pp. 138*).—This is a detailed account of the proceedings of the convention held at Des Moines, Iowa, November 1–3, 1904, a shorter account of which has been given (E. S. R., 16, pp. 426–438).

Proceedings of the ninth annual meeting of the American Association of Farmers' Institute Workers, edited by W. H. BEAL, J. HAMILTON, and G. C. CREELMAN (*U. S. Dept. Agr., Office Expt. Stas. Bul. 154, pp. 90*).—This is a detailed account of the proceedings of the meeting held at St. Louis, Mo., October 18–20, 1904.

Agriculture in the public schools, M. M. PARKS (*Ann. Rpt. Dept. Ed. Ga., 33 (1904), pp. 153–167*).—A discussion of the educational value of elementary agriculture in school courses.

Agriculture in the rural schools, J. C. McDOWELL (*N. Dak. Farmers' Inst. Ann., 1904, pp. 172–180*).—This is an address giving a general review of the extent to which elementary agriculture is taught in the schools of the United States, and presenting arguments for teaching this subject by means of laboratory exercises and text-books.

Teaching agriculture in common schools, C. B. CHAPMAN (*Ann. Rept. Dept. Ed. Ga., 1904, pp. 139–144*).—Suggestions for illustrative exercises in elementary agriculture.

Tree planting, school gardening, and schoolroom decoration in Nebraska (*Lincoln, Nebr.: Dept. Pub. Instr., 1905, pp. 49, pls. 2, figs. 57*).—This is a pamphlet published by the Nebraska Department of Public Instruction in its "crusade for better school environment."

It contains leading articles, as follows: Tree Planting on Nebraska School Grounds, by Frank T. Miller; Ornamentation of the School Grounds, by W. H. Barnes; The Country Schoolhouse and Its Grounds, by Hon. James Wilson; The Planting of School Grounds, by Susan Huntington Hooker; A Girl's Vegetable Garden, by Ida M. Angell; The Planting of Rural School Grounds, by Chas. A. Scott; Hints on Rural School Grounds, by L. H. Bailey; Tree Planting on the Government Forest Reserve, by Chas. A. Scott, and Schoolroom Decoration, by Nellie May Schlee.

A list is given of prizes aggregating over $500 in value, which were offered by publishers, school supply houses, nurseries, and the State Fair Association for the improvement of school grounds and growing of vegetables, and for specimens of manual

training, drawing, and other work, which the department of public instruction is trying to promote.

Geography, nature study, and agriculture in the elementary schools, C. L. Coon (*N. C. State Supt. Pub. Instr., Teachers' Bul. 2, pp. 32*).—The three subjects considered in this bulletin are treated with reference to the common bearing they have upon the natural environment of children.

In geography such common things as soil, plants, animals, and weather are considered in their general relation to man; in nature study the arousing of the interest of children in plants, animals, weather, and the soil; and in agriculture the culture of the fields, or weather, soil, plants, and animals, considered as agencies in affording man shelter, food, and clothing. With this interrelation of geography, nature study, and agriculture in mind suggestive outlines are given for geography in the first 7 grades of the elementary school, for nature study at different seasons of the year, and for agriculture with a text-book as a basis for the work. There is also a discussion of school-garden work and a list of books on nature, geography, and agriculture for teachers and older pupils.

MISCELLANEOUS.

Seventeenth Annual Report of Massachusetts Station, 1904 (*Massachusetts Sta. Rpt. 1904, pp. 178*).—This includes the organization list of the station, a list of available publications, a financial statement for the fiscal year ended June 30, 1904, and reports of the heads of departments for the most part noted elsewhere.

Seventeenth Annual Report of Mississippi Station, 1904 (*Mississippi Sta. Rpt. 1904, pp. 42*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1904, a report of the director on the work of the station and McNeill branch station during the year, reports of the different departments of the station, some of which are noted elsewhere, and a report of the assistant director on the work at the McNeill branch station.

Fifteenth Annual Report of North Dakota Station, 1904 (*North Dakota Sta. Rpt. 1904, pts. 1, pp. 183; 2, pp. 208*).—Part 1 contains a report of the director, a financial statement for the fiscal year ended June 30, 1904, and reports of the different departments containing the results of experimental work noted elsewhere. Part 2 is the report of the food commissioner, also noted elsewhere.

Annual Report of Pennsylvania Station, 1904 (*Pennsylvania Sta. Rpt. 1904, pp. 294*).—This contains the organization list of the station; a financial statement for the fiscal year ended June 30, 1904; a report of the director on the work of the station during the year; and reports of divisions, which contain several articles abstracted elsewhere.

Seventeenth Annual Report of Vermont Station, 1904 (*Vermont Sta. Rpt. 1904, pp. 365–587*).—This contains the organization list of the station, a financial statement for the fiscal year ended June 30, 1904, a report of the director reviewing the work of the station during the year and giving abstracts of Bulletins 100–108 of the station, and reports of the heads of departments containing articles abstracted elsewhere.

Abstract of Seventeenth Annual Report, 1904 (*Vermont Sta. Bul. 111, pp. 21–68*).—This is a résumé of the annual report of the station noted above.

A guide to the grounds of the agricultural experiment station at Kingston, Rhode Island (*Rhode Island Sta. Bul. 104, App., pp. 15, dgms. 2*).

List of abbreviations employed in Experiment Station Record for titles of periodicals, E. W. Allen and Mrs. D. K. Murphy (*U. S. Dept. Agr., Office Expt. Stas. Circ. 62, pp. 74*).—This has been noted editorially (E. S. R., 16, p. 841).

NOTES.

California University.—The college of agriculture announces 6 short courses for the autumn and winter of 1905–6, among which are courses in viticulture, nutrition of man and domestic animals, irrigation, and the reclamation service.

Colorado Station.—The station has begun some cooperative work in forestry through the State, furnishing seedlings for these trials and some supervision. A horse barn is being built for use in connection with the cooperative experiments with this Department in horse breeding.

Illinois University.—*The Illinois Agriculturist* states that the enrollment in the college of agriculture exceeds that of last year by one hundred. "All conditions indicate that the total enrollment for the year will reach five hundred or over." A greater percentage of the new students have had a high school training or its equivalent than formerly, and have matriculated at once and entered upon the prescribed course.

Iowa College and Station.—J. B. Davidson has been elected assistant professor in agricultural engineering to succeed C. J. Zintheo, who, as previously noted, resigned to take up work in farm mechanics in connection with the irrigation and drainage work in charge of this Office. E. T. Robbins has been elected to the position of assistant in animal husbandry, to succeed W. W. Smith, who has been elected assistant of animal husbandry at Purdue University.

Kansas College and Station.—At a recent meeting of the board of regents, a resolution was passed materially extending the duties of the director of the station and defining the function of the station council. The director is to have immediate charge of all the work of the station, including that of the branch station, and be held responsible for its execution. He is also to have charge of the expenditures of the stations, the publications, and other business matters. Reports are to be made to the board annually, and a plan of the work and the expenditures for the year is to be submitted each spring. The new plan will materially strengthen the organization of the station.

The department of dairy and animal industry has been divided, O. E. Erf remaining in charge of the dairy husbandry department, and the animal husbandry department placed in charge of R. J. Kinzer.

A wheat and corn special, manned by experts from the college and station, was run this fall over the Rock Island system in Kansas, the work occupying two weeks, beginning November 6. Stops of 30 minutes were made along the route, the schedule including nearly 150 towns. There were two coaches for audience rooms, one used for the talks on wheat raising and the other on corn.

Maine University.—G. E. Tower has been appointed professor of chemistry in the university, A. W. Gilbert instructor in agriculture, and L. T. Ernst assistant in horticulture.

Michigan College and Station.—A number of experimental silos are being constructed of cement and of wood. The materials of the latter are of several different kinds, and are treated in a number of different ways, to test their durability and efficiency.

Missouri Station.—F. W. Liepsner has been appointed assistant chemist in connection with the soil survey work, and C. H. Hechler assistant in animal husbandry in connection with the feeding experiments now being conducted in cooperation with this Department.

Cornell University.—The registration in agriculture at Cornell University up to October 20 is reported as 216, as compared with 178 last year. This is relatively the largest increase in any department of the university.

New York State Station.—W. H. Andrews, for more than ten years assistant chemist at the station, died September 29 from Bright's disease, after a long illness. In his death the station loses a most faithful and efficient worker and his associates a sincere and genial friend.

North Carolina Station.—W. F. Massey has resigned his position as horticulturist and will devote himself to editorial work. Charles Walker has discontinued his work as assistant chemist to the station, and will hereafter devote his whole time to teaching. O. L. Bagley and R. H. Harper, graduates of the class of 1905, have been appointed assistant chemists to the station.

Pennsylvania Station.—J. H Parkins, of Fort Defiance, Virginia, has succeeded R. E. Stallings as assistant in animal nutrition.

Rhode Island Station.—Hugh L. Barnes, a graduate of the Massachusetts Agricultural College in the class of 1905, has been appointed assistant horticulturist, vice M. A. Blake, who, as previously noted, has gone to the Massachusetts Agricultural College.

Graduate School of Agriculture.—It has been decided to hold the second session of this school in the summer of 1906 at the agricultural college of the University of Illinois, under the auspices of the Association of American Agricultural Colleges and Experiment Stations and the University of Illinois. Details regarding the date of the school and the courses to be offered will be announced later.

Opening of Nova Scotia Agricultural College.—The Nova Scotia College of Agriculture, located at Truro, opened its first session for regular students on October 17, with an enrollment of twenty. Short courses in animal industry have been given at the government farm in the two previous years. Applications for admission to the short course, to begin January 30 next, have been received from over 100 intending students.

East of Scotland Agricultural College.—At a meeting of the board of directors of the East of Scotland College of Agriculture, held at Edinburgh, the chairman of the "central studies committee" reported that 58 students received benefit from the central classes last season, as against 60 in the previous year. There was a large increase in the number of students attending the evening classes, there being 170 as compared with 43 the previous year. The "county work committee" reported that during the last year there were 12,917 students in attendance. In the systematic classes there were 645 students—341 in dairying, 272 in forestry, and 32 in general farming. Application is to be made to the Committee of Council on Education in Scotland for a grant to the college, as there is great need of funds for certain classes of its work.

Forestry at the University of Cambridge.—The syndicate appointed to consider the desirability of establishing a course leading to a diploma in forestry at the university has reported, according to a note in *Nature*, (1) that a diploma in forestry should be established; (2) that forestry should form the principal subject of the final examination for the diploma; (3) that the diploma should be granted only to graduates of the university; (4) that candidates for the diploma should show evidence of having resided for the equivalent of one year in some recognized center of instruction in practical forestry. If these recommendations are approved by the senate, the syndicate proposes to draw up and submit to that body detailed regulations for the scope

and conduct of the proposed examinations, and for the courses of lectures and practical instruction to be required of candidates for the diploma.

Elementary Agricultural Education.—*The Nebraska Farmer* for October 19 is the annual agricultural school number. It contains an article on Nebraska's Western Experimental Substation, a History of the Nebraska School of Agriculture, short articles and notes concerning features of agricultural instruction in Missouri, South Dakota, Iowa, and New York, an article on Agriculture in the Public Schools, by E. C. Bishop, deputy state superintendent of public instruction, and one on The Growth, Development, and Future of Agricultural Education in America, by Chancellor E. Benjamin Andrews.

The author of the latter article in tracing the development of agricultural education in America gives credit to the experiment stations for the first real progress in this direction, in that the investigations conducted by the stations "furnished what was originally lacking--data for instruction in agriculture and the subjects relating thereto." He estimates that the greatest result to be accomplished by the colleges of agriculture is likely to be the creation of a "demand that farmer boys and girls shall not only have the training which the schools afford, but shall have in addition to that a college training in agriculture."

The Nebraska State Department of Public Instruction, in cooperation with the college and school of agriculture, is making an active campaign for the extension of agriculture to the public schools. As a feature of this work the department has announced a State meeting, December 14 and 15, of the boys engaged during the past year in a corn-growing contest, in connection with which there will be a girls' corn-cooking contest. At the time of this meeting it is proposed to organize the Nebraska Boys' Agricultural Association and the Nebraska Girls' Domestic Science Association. Each of these organizations will have branch county organizations, subordinate to which will be school district organizations. A leaflet recently issued by the department of public instruction gives suggestions for the organization of these different subordinate associations.

In the Waterford (Pa.) High School, 29 boys and 6 girls out of a total enrollment of 80 are taking the agricultural course. Elementary agriculture is now starting on its second year in the high school and is very popular. An excellent feature of the work is the laboratory work in plant life and agricultural chemistry, and outdoor work in judging cattle, horses, sheep, and swine on nearby farms.

A winter school of agriculture is announced by the Essex Education Committee, to be held at the County Technical Laboratories, Chelmsford, England, from November 20 to December 23, 1905, and from January 8 to February 3, 1906. The first course will be devoted to the soil and its cultivation and tillage crops, and the second course to fodder crops and farm stock. There will also be instruction in chemistry, physics, botany, and zoology, accompanied by practical laboratory work.

Market-day lectures are announced as another feature of educational work at the laboratories for 1905–6. These are Friday afternoon lectures, and are free for farmers and others interested in agriculture. Seventeen such lectures were given in the autumn and winter of 1904–5, and abstracts of the lectures were subsequently published for general distribution. Some idea of the character of these lectures can be gleaned from the following titles: Manuring of market-garden crops, marketing of farm produce, agricultural cooperation, hints on the management of a flock, improvement of pastures, plant breeding, poultry keeping, varieties of soils, cultivation of maize, and taints in milk.

Promotion of Agriculture in Porto Rico.—Press reports state that the establishment of a bureau of agriculture for Porto Rico is in contemplation. The University of Porto Rico, at Rio Piedras, near San Juan, has a 100-acre farm which the trustees propose to use for illustrating improved methods and for giving students practical training in agriculture. There is now a class of 28 such students. The present herd

of 12 cows is to be doubled, and a model dairy installed. The institution is now selling its milk to people in the neighborhood, and with the new equipment it is proposed to handle and put up this milk according to the most modern sanitary methods. An attempt will also be made to improve the dairy stock by the importation of a blooded bull from this country.

Thoroughbred swine are also to be introduced, and 3 stallions. One of these stallions will be kept at the university, one at the experiment station, and the other at some convenient point on the south side of the island. Slips sufficient for the planting of 100 acres of sisal will arrive within a short time, and will be distributed to persons who wish to experiment with the growing of this fiber plant. In numerous ways the propaganda for the improvement of conditions will be carried on with the cooperation of the Federal experiment station at Mayaguez, whose pioneer work has paved the way for this more popular work about the island.

Conference on Texas Fever Tick.—In connection with the annual session of the Southern States Association of Commissioners of Agriculture, held at Richmond, November 22–24, a conference was called of station directors, entomologists, veterinarians, representatives of this Department, and others interested in the question of cattle tick extermination. The purpose of the conference was to formulate definite recommendations to be presented to the commissioners of agriculture, looking to concerted action and cooperation in the extermination of the cattle tick through the South.

Reclamation Funds.—The estimated amount to be covered into the Treasury to the credit of the reclamation fund for the past fiscal year is, according to *Forestry and Irrigation*, \$4,757,978.87. The largest amount, \$870,290.01, was from the sale of public lands in North Dakota, followed by \$675,325.60 from Oregon, \$572,633.54 from Oklahoma, and \$522,203.50 from Washington. The amounts derived from other States were as follows: Arizona \$47,449.52, California \$361,557.87, Colorado \$270,060.25, Idaho \$370,272.90, Kansas \$30,478.36, Montana \$350,031.30, Nebraska \$120,786.59, Nevada \$12,157.93, New Mexico \$85,602.58, South Dakota \$174,448.96, Utah \$50,716.82, and Wyoming \$243,962.94.

Miscellaneous.—An account of the Idyllwild School of Forestry is given in the October issue of *Forestry and Irrigation*. This is a summer school, conducted for a term of two months in the San Jacinto Mountains, in Riverside County, Cal. Several permanent buildings have been erected, and lecturers and instructors are in attendance upon the course. Among those who lectured in the course the past summer were A. V. Stubenrauch, of the California College and Station, and T. P. Lukens and A. T. Searle, of the Forest Service of this Department.

With the inauguration of a 4-year course of study at the agricultural high school of Vienna, the right has been given the school to confer the doctor's degree ("*Doktor der Bodenkultur*"). The course was formerly a 3-year one, and there has long been an effort to raise the grade of work done by the school. The present action places it on a par with the universities and technical high schools.

The enrollment of agricultural students at the University of Leipsic, according to a recent note in *Fühling's Landwirtschaftliche Zeitung*, is now 152. Of these students 28 come from the Kingdom of Saxony, 44 from the Kingdom of Prussia, 21 from the remaining States of the German Empire, 15 from Austria-Hungary, 32 from Russia, 11 from other European countries, and 1 from North America. One hundred students entered the college for the 1905–6 session.

The inaugural address at the opening of the present session of the Southeastern Agricultural College at Wye, England, was delivered by Prof. H. Marshall Ward, of the University of Cambridge, and was upon the subject Botany and Agriculture.

A recent number of *Fühling's Landwirtschaftliche Zeitung* announces the establishment of an agricultural winter school at Weener, East Friesland, Prussia, with Mr. Schroer as director.

During the past year experiments with fertilizers and different field and garden crops have been conducted on the farm of the training school for feeble-minded girls and boys at Vineland, N. J., under the auspices of the Pomona Grange Experiment Committee. This committee has also been instrumental in having similar experiments conducted by farmers in different parts of the county.

In his message at the recent opening of the Mexican Congress, President Diaz announced that arrangements had been completed for the establishment of three experiment stations.

At the first regular meeting of the National Council of Horticulture, held in Cleveland October 4, the desirability of exploiting horticulture through the public press was considered. It was believed that much good could be accomplished at the present time by thus promoting horticulture in a broad way, especially along the nursery, floriculture, and seed lines. To this end leading firms in these trades will be solicited for contributions to carry on the work. Other matters considered were the standing powers of the society relative to national questions affecting horticultural interests, such as postage, customs, transportation rates, nomenclature, and the like.

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EXPERIMENT STATION RECORD.

VOL. XVII. DECEMBER, 1905. No. 4.

The report of the Secretary of Agriculture for 1905 departs from the usual form of a progress report for the year, with a result which is unusually interesting. It is noteworthy as being the ninth annual report issued by Secretary Wilson, and owing to this unusual period of service he takes occasion to review some of the more salient features of development which have taken place in his time and to sum up the progress in a number of new lines. It is therefore a progress report for the past eight years, with such comparisons as are necessary to an understanding of the great change which has been wrought.

Such a review as this is extremely useful as well as interesting, for it will enable the general reader to get a proper perspective of the Department's work, and furnish convincing evidence to legislators and others who are watching the growing appropriations for this branch of the Government. Growth has been so steady that it is necessary to pause and view the Department in retrospect in order to realize the extent and character of the changes which have been involved. The appropriations have more than doubled in the past eight years, although it had required over forty years to reach the figure they had attained in 1897. This large increase in itself suggests the desirability of a report as to what has been accomplished in the upbuilding of a great Federal Department, and in the promotion of agriculture as a national industry. By anticipating a call for such a showing the Secretary indicates his desire to keep the public fully posted in this respect and to still further strengthen confidence in the Department.

In order that the magnitude of the interests consigned to him, as well as the far-reaching influence of this basal industry upon other industries, may be properly appreciated, Secretary Wilson prefaces his résumé with some striking statistics of agricultural production. He estimates the wealth of production on farms in 1905 at $6,415,000,000, "the highest amount ever attained by the farmer of this or any other country, a stupendous aggregate of results of brain and muscle and machine." This is an increase of thirty-six per cent over the census figures of six years ago. It is not only sufficient to supply the wants of eighty-three millions of our own people, but last

year farm products to the value of $827,000,000 were exported. The enormity of the nonagricultural industries which are directly dependent upon the farmer and his extraordinary productive ability is likewise supported by striking figures.

In a recent address Secretary Wilson said that when he came to the Department he found it necessary to build it up and strengthen it, before he could render the aid he had in mind to the agricultural colleges and experiment stations of the country. One important measure of the extent to which this upbuilding has taken place is found in the personnel of the Department. The total number of persons on the rolls of the Department in 1897 was 2,443, including 925 who were rated as scientists and scientific assistants. Last July there were 5,446 persons on the rolls of the Department, 2,326 of whom were rated as scientists and scientific assistants. These figures show an increase of over 3,000 persons in the total force, and of 1,401 in the scientific staff.

This increase in personnel and in appropriations has naturally gone hand in hand with the development and extension of the Department's work. Taking up the different branches, the Secretary points to some of the more important developments and achievements as indicating the lines along which growth has taken place, and illustrating the methods by which the Department seeks to work for the practical benefit of the farmer. There has been important reorganization, such as bringing together several straggling divisions into a Bureau of Plant Industry; and other lines have been enlarged and strengthened and developed into bureaus.

The work in forestry, for example, which has grown to a position of such recognized importance, may be said to be a product of the past eight years. At the beginning of 1898 the Division of Forestry employed eleven persons, six of whom filled clerical or other subordinate positions. Practically all of its work was office work. The actual introduction of forestry began in 1898, when, with the offer of practical assistance to forest owners in the management of their tracts, "the field of action shifted from the desk to the woods." The growth of interest in forestry, in conservative lumbering, in forest reservations, and in education in this branch is too familiar to call for comment. Public opinion has undergone a great change, and a sound national sentiment has been created. The large and varied interests dependent upon the forest have been awakened to the urgent need of making provision for the future, and States have been led to enact wise laws and enter upon a well-considered forest policy. The Secretary holds that if the Forest Service had not taken the lead in finding out just how practical rules for conservative lumbering might be laid down and carried out forestry would not have reached the point at which it now stands in the United States.

The agricultural experiment stations in Alaska, Hawaii, and Porto Rico have been established and placed upon an efficient working basis under the present administration and the influence and assistance of the Department have thus spread to these remote possessions. The investigations in problems relating to irrigation from an agricultural standpoint, as distinguished from that of engineering, have been inaugurated and organized upon a comprehensive scale. This work has proved so eminently practical and so important to irrigated agriculture that it has grown rapidly in extent and in the scope covered in its studies. Out of it have sprung the work in land drainage, which has already demonstrated great possibilities of usefulness, and the still newer investigations upon agricultural machinery, so that there has been created and put into operation a new feature of work covering the whole range of rural engineering, as a highly important division of the Department's activities.

The Weather Bureau has greatly extended the range of its observations and investigation, which has been attended by increasing efficiency and a wider application of its work. It is now said to be the most highly developed weather service in the world. The work in economic entomology has been extended to many new lines of study upon injurious and beneficial insects of the farm, garden, forest, and household, and has been more than doubled in scope, not to mention the extensive scale on which the Bureau has worked in the campaign against the cotton-boll weevil. The soil survey has been entirely developed during the present administration, and constitutes the first systematic attempt to make a comprehensive soil survey of the United States.

The Secretary points to the successful eradication of the foot-and-mouth disease in New England, and the diverse efforts which have been made to offset the evils of the cotton-boll weevil in the Southern States, both prosecuted with special appropriations for the purpose. In the latter connection, as well as independent of it, the breeding and selection of plants and varieties better adapted to special conditions or uses has been a conspicuous feature; and closely related to it is the introduction of plants from foreign countries. In 1898 Secretary Wilson secured authority to use a small portion of the Congressional seed fund for agricultural exploration, which has resulted in extensive introduction of seeds and plants which have been tested the country over. The largest collection of date palm varieties in the world has been secured in this way, and several important cereal introductions have been made, such as durum or macaroni wheat, the Spanish Select oat, and the Sixty-day oat. Durum wheat was first introduced from Russia in the spring of 1899. It is estimated that from twelve to fifteen million bushels of this wheat were grown this year in the three States of North Dakota, South Dakota, and Minnesota, and that

the crop in other sections of the country will bring the production up to twenty million bushels for the entire country. This wheat has evidently passed the experimental stage and is now an established crop in a considerable number of the semiarid States.

Referring to the propaganda for sugar-beet culture, inaugurated soon after the present Secretary came to the Department, and the widespread tests of its adaptation to different parts of the country, this industry is pointed to as one which has become well established in favored localities, whose farming side has been greatly benefited by scientific investigation. In 1897 there were but nine beet-sugar factories in the country, with a combined output of thirty thousand short tons of sugar; the estimated output for 1905 is two hundred and eighty thousand short tons. Similarly, rice culture in the Southern States, especially Louisiana and Texas, has been exploited and encouraged by the introduction of Japanese varieties, and has grown very greatly in extent.

In addition to the important investigations of the Bureau of Animal Industry on contagious diseases of animals and their means of control, the meat inspection in its charge has steadily increased. Upon this work depends in very large degree a foreign trade worth millions of dollars yearly to American stock raisers. This year the inspection covered sixty-six million live animals before slaughter, and over forty million carcasses after slaughter, representing an increase in this work of about 33⅓ per cent in the past eight years. The inspection work has also been extended to other food products intended for export, and to all foods imported into the United States, for which purpose branch laboratories of the Bureau of Chemistry have been established in the ports of New York, Boston, Philadelphia, New Orleans, San Francisco, and Chicago. A system of food standards has also been worked out as a basis for guidance in Federal, State, and municipal food inspection.

And so on throughout the report. Taking up the work of the different bureaus and divisions, the Secretary points out the more important lines of development, and enumerates the many lines in which investigations have been prosecuted with practical application to American agriculture. The showing is indeed a gratifying one. The presentation is clear and direct, and affirms how definite has been the aim in the development of the Department's work along the various lines of activity. No one can read the report without a fuller appreciation of the extent and the ramifications of the Department, and of the very many ways in which it is serving the farming public and contributing to the general welfare of the country. It is as broad in its sympathies as the relationships of the industry it stands for, and no legitimate interest within its scope will fail to awake a responsive chord when it appeals to the Department for aid.

But the very breadth and diversity of the interests concerned suggests that the Department can not be sufficient unto itself, and the Secretary is not unmindful of the other agencies which have contributed in such an important degree to this great work. He makes appreciative acknowledgment of the services of the agricultural experiment stations as cooperative agencies, and of their importance from both a local and a national standpoint.

The Secretary outlines as the twofold object of the Department that of adding to the sum of intelligence of the man, and increasing the productive capacity of the acre, and he adds that "in this important work it has the hearty cooperation of the State agricultural colleges and experiment stations, all of them working with the Department of Agriculture toward the same great end." By means of the close relations which have existed "the range and effectiveness of many agricultural investigations have been enlarged, and it has been possible to bring the Department's work into vital touch with agricultural industries and agricultural people. . . . Not only have the stations been a vital factor in making the Department's work more effective, but they have by their own investigations lifted American agriculture to a higher plane."

Furthermore, the Department and the experiment stations are "gathering the materials which will constitute the future of education in agriculture, and the permanent impression which their work will make on agricultural practice will be largely determined by their success in incorporating the results which they obtain in courses of instruction to be given the youth in agricultural colleges and schools." These are, after all, the most important considerations, for they are the most abiding and will have the greatest permanent influence in elevating and improving American agriculture in the broadest sense.

Secretary Wilson declares his purpose to render all the assistance to the stations which the Department can give them, but he recognizes that something more is required for further development along their own particular lines of endeavor. He accordingly indorses their appeal to Congress for increased appropriation in the following language: "In the increasing demand for more light on agricultural practices and the growing interest in rural life generally, the stations must have the means for meeting these demands. It is hoped that Congress will recognize this need, as it is already being recognized by some of the States themselves. There is no direction in which public moneys can be appropriated that will bring more certain and lasting returns than in helping the State experiment stations to do more research work."

For more than a hundred years, Texas fever, referred to under different names, has been one of the most serious scourges of the

cattle business in the Southern States. The tremendous losses incurred as the result of attempts at traffic in cattle between the North and South brought the matter prominently before the Federal Government in 1868, after which Dr. Curtice and others, under the direction of Dr. D. E. Salmon, carried on investigations regarding the nature of the disease and practical means of controlling it.

After a long series of experiments by the Bureau of Animal Industry, Drs. Smith and Kilborne demonstrated, in 1893, that the disease is transmitted from one animal to another by means of the cattle tick. It was also shown that susceptible cattle could be rendered immune to the disease by inoculating them with the blood of other cattle which had recovered from the disease. The elaboration of this method by the Missouri and Texas stations and others rendered it possible for northern breeders of blooded stock to immunize the animals which they wished to ship south, and thus avoid the serious losses which they would otherwise suffer.

Promising as this method has become, it has long been apparent that objections attach to it. In the first place, the immunity thus produced is not absolute. In some portions of the quarantined area native animals immunized by gradual tick infestation from early calfhood may subsequently succumb to Texas fever as a result of excessive infestation with ticks, or from infestation with unusually virulent ticks. Moreover, the method of immunization is not a permanent remedy for Texas fever, but requires a continual outlay and treatment for all susceptible animals, including native southern cattle on tick-free pastures as well as cattle north of the quarantine line intended for shipment into the South.

Obviously, the most perfect system of immunization does not remove the quarantine line, or permit the transportation of cattle from the Southern States to the northern markets without the inconveniences and restrictions which are required in dealing with such cattle. On account of this inadequacy, a number of investigators have for several years been working along another line of attack which gives hope of ultimate success. Drs. Cooper Curtice, Tait Butler, Prof. H. A. Morgan, and other investigators have demonstrated that by a simple method of pasture rotation, ticks may be eradicated from infected pastures within a single year. During the past four years Dr. Butler has practically eradicated ticks from twelve counties in North Carolina at a total cost of $15,000, and in this time not a single case of reinfestation in the area of operation has occurred.

The method of eradication is based upon known facts concerning the life history of the cattle tick, without the agency of which Texas fever can not be transmitted. The engorged cattle tick drops to the ground from infested cattle, lays its eggs, which hatch into young so-called seed ticks, and these remain upon the grass until opportunity is offered to attach themselves to cattle. After attachment they remain upon

the cattle until fully engorged and ready to drop to the ground for the deposition of eggs. It has been shown possible, therefore, to free infested animals of their ticks by placing them upon tick-free pastures in November, December, and January, during which time all ticks drop to the ground; and since the eggs will not hatch in winter, there is no risk of reinfestation during that time.

The seed ticks may live without animal hosts from September until April, but survive a much shorter time in summer. They may, therefore, be starved out by keeping stock off the infested pasture for sufficient time, or they may be destroyed by plowing the land. The cattle are then placed on tick-free pastures.

Morgan and other investigators have pointed out a way by which both animals and land may be freed of ticks in midsummer by means of the feed-lot system, the animals being excluded from the main portion of the pasture from June 1 until late autumn. Two feed lots are employed, the animals being kept in each twenty days, and the lots then plowed. Without discussing the details of this plan, which have been published by the experiment stations of Louisiana and Tennessee, it is claimed, on the basis of practical trials, that by the feed-lot method the stock on a given farm may be freed of ticks within a period of forty days, even in midsummer.

The importance of these methods to the cattle industry of the South, and to traffic of cattle between the North and South, was never more clearly set forth than at the recent meeting of the commissioners of agriculture of the Southern States at Richmond, Va. In connection with this meeting, about thirty veterinarians, entomologists, and others interested in the South, held a conference on the subject of tick extermination, notice of which had previously been sent out.[a]

It appeared during these discussions that the cattle tick is a serious pest aside from its agency in carrying Texas fever. It was said, for example, to be impossible to produce a high quality of beef in tick-infested regions. The presence of ticks stunts the growth of cattle so that they are from 200 to 300 pounds short in weight at maturity, as compared with northern-grown cattle. In some instances the presence of ticks is reputed to influence the fecundity of dairy cows to such an extent that they fail to breed until the age of 5 or 6 years. Cattle are also reduced in condition from excessive infestation to such an extent as to lead to death from starvation and irritation. In addition to these annoyances which the southern cattle raiser must suffer, the packers offer from one-fourth to one-half cent per pound less for southern than for northern animals of the same quality. Southern animals must be kept in separate pens, and are considered as tainted and dangerous, and therefore of less value.

According to statistics furnished by the Census of 1900, of the

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[a] E. S. R., 17, p. 311.

fifteen million cattle accredited to the quarantined States, the adult cattle were valued at $7 per head less than similar animals in the North. Since this difference of $7 per head is partly attributable to the presence of cattle ticks, it is thus apparent that this pest causes a great loss apart from the other annoyances and financial losses occasioned by its existence. Its influence is even more far-reaching, for by retarding development in animal husbandry it greatly hinders the spread of diversified farming and becomes one of the greatest impediments to the improvement of the soil and other agricultural conditions.

It was generally agreed by those who had given attention to this problem that tick extermination from the South is both possible and practicable, and that it will be accomplished. In order to get effective action from this unanimous sentiment the conference adopted a resolution requesting Congress to make a liberal appropriation for the dissemination of knowledge concerning the methods of tick extermination, and for the work in pushing the quarantine line farther and farther to the South. The commissioners of agriculture of the quarantined States were also urged to use all possible efforts in securing such uniform legislation as is necessary to bring about the most effective cooperation between the State and Federal authorities in this work.

While, therefore, it is generally recognized that effective methods of tick extermination have been worked out, it remains to carry on a system of demonstration and education for the benefit of stockmen. Stock laws must also be passed in localities where such laws do not exist in order that the movements of stock may be regulated. Wherever such laws do exist it is possible to proceed at once with tick extermination, and it is believed that with the proper educational forces in the field, in the line of farmers' institutes and personal contact with interested stock raisers, the natural difficulties in inaugurating such a movement will be overcome and the movement itself will proceed with satisfactory speed.

The conference was one of great importance and developed much enthusiasm and confidence. The subject was considered as being fundamental to southern agriculture. With the knowledge already at hand regarding the habits and life history of the cattle tick, and the proper machinery set in motion to secure concerted action, there is more encouragement than ever before to look forward to the ultimate eradication of this scourge. The interests involved should lead every State and every farmer to do his part well. The work can be carried on smoothly and economically only when the most thorough cooperation is realized. It will be necessary for the individual farmer not only to appreciate the desirability of eradicating the ticks, but of cooperating in the work with the county and State officials and the Federal Government.

CONVENTION OF ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

The nineteenth annual convention of this association was held at the Shoreham Hotel, Washington, D. C., November 14–16, 1905. The meeting was one of unusual interest and success, and the attendance was larger than on any previous occasion. The registration was undoubtedly swelled by reason of the annual conventions in Washington of several other related bodies, which occurred at about the same time. Among these were the Associations of State Universities, of Farmers' Institute Workers, of Horticultural Inspectors, and of Official Agricultural Chemists. An unusual number of persons interested in industrial education and agricultural experimentation was thus brought together in Washington, and a large proportion of these attended the sessions of the Association of Colleges and Stations, in whole or in part. Over 250 persons registered, and the delegation which paid its respects to the President on the afternoon of the first day of the convention included a considerably larger number.

GENERAL SESSIONS.

The association was addressed at the opening session by Hon. James Wilson, Secretary of Agriculture, and a former member of the association. He declared his deep interest in the work of the association and his belief in the purposes of the institutions represented. His intention upon first coming to the Department had been to make it helpful to the experiment stations, but he found that it was first necessary to strengthen the Department itself. This he had done by building up the staff of workers and securing increased appropriations from Congress; and the stage had been reached where more attention could be given to aiding the stations. Secretary Wilson declared the greatest need of the stations to be more money, and he stated that in his forthcoming report to Congress he had strongly recommended that larger appropriations be made for the use of the stations. He held that this would be an economy measure, since there is no economy so far-reaching as the strengthening of the American farmer.

The annual presidential address was delivered by Dr. E. B. Voorhees, of New Jersey, on the evening of the first day of the convention. This related in the main to some of the duties and responsibilities of the agricultural colleges and experiment stations. Doctor Voorhees

held these colleges primarily responsible for the kind and amount of work done by the stations, because the working staff is the first determining factor in station work, and it is to the colleges that we must look for the fundamental training for this work. He urged the need of more research work on the part of the stations, and declared that the lack of the present limitations were largely due to the inadequate supply of broadly trained men capable of planning highly scientific investigations. The speaker called specific attention to lines in which agriculture is in need of investigation, to prevent losses of stock and products, and to bring districts now largely wastes into more profitable cultivation. These illustrations were presented to show that "it is the manifest duty of this association, as representing both the colleges and the stations, to see to it that provision is made for the specific training of investigators; for, all things considered, our progress has been measured and its limits fixed by the available men, rather than by material equipment."

The report of the executive committee, presented by Dr. H. C. White, chairman, briefly reviewed the activities of the committee during the year, notably in securing modification of the orders of the War Department with reference to military instruction in the land-grant colleges, and its efforts in behalf of the bills before Congress for the increase of the experiment station appropriation and for the establishment of mining schools. The committee believed that the association should concentrate its efforts on a single bill, rather than attempt the support of several measures. This suggestion led to considerable discussion later in the meeting, which brought out the quite general feeling that preference should be given to the Adams bill; but to avoid embarrassing the executive committee by too rigid restrictions it was instructed to concentrate its efforts upon the bill apparently in the most favorable condition for passage, provided the mining bill be so modified as to recognize the land-grant colleges as the beneficiaries.

The executive committee suggested a reorganization of the standing committees of the association, and made recommendations in this regard, which were referred to a special committee, whose report, presented later, provided for four standing committees, viz, (1) instruction in agriculture, (2) graduate study, (3) extension work, and (4) experiment station organization and policy. These committees are to consist of six members each, to be appointed by the retiring president, and provision is made for a gradual rotation in the membership so that the terms of only two members will expire each year. Vacancies occurring during the year are to be filled by the committees themselves. The appointments upon these committees, with the terms of office, are as follows: *Instruction in agriculture*—A. C. True and T. F. Hunt, three years; H. T. French and H. C. White, two years; J. F. Duggar and W. E. Stone, one year. *Graduate study*—L. H. Bailey

and H. P. Armsby, three years; M. H. Buckham and R. H. Jesse, two years; W. O. Thompson and Brown Ayres, one year. *Extension work*—K. C. Butterfield and C. R. Van Hise, three years; B. W. Kilgore and C. F. Curtiss, two years; A. M. Soule and W. M. Hays, one year. *Experiment station organization and policy*—E. Davenport and C. D. Woods, three years; W. A. Henry and H. J. Waters, two years; M. A. Scovell and C. E. Thorne, one year.

In the course of its report the executive committee referred to the death during the year of President H. H. Goodell, who had been an active worker in the association since its organization, a member of its executive committee for fourteen years and chairman of that committee for eight years. The committee had made special provision for a memorial address upon the life and services of President Goodell, which was presented by President W. E. Stone. In this the speaker paid an eloquent tribute to President Goodell, his work and achievements, his indomitable energy and perseverance in what he undertook, and especially those sterling qualities of heart and mind which commanded the esteem and affection of all who came to know him. "He lived a full and rich life of service in a great cause, and left a record of permanent achievements, but the finest and best of his life was known only to his intimate friends and to his students, to whom he revealed a true nobility of conduct and a splendid character that was an inspiration to all who came within its influence."

Resolutions of respect and esteem were adopted by the association, and the address was ordered printed, separate from the proceedings, for more general distribution.

Dr. A. C. True presented the report of the bibliographer of the association, noting nearly a hundred bibliographies which had appeared during the year upon subjects of interest to agricultural investigators. Most of these have been listed in this journal. The report of the treasurer, J. L. Hills, showed receipts for the year of $1,563, expenses amounting to $1,200.05, and a balance on hand of $995.87.

The report of the committee on uniform fertilizer and feeding-stuff laws, by Dr. H. J. Wheeler, chairman, showed that there had been several new laws passed or modifications of old laws during the year, which had in general followed the recommendations of the committee, and that in several other States there was dissatisfaction with the present laws which might lead to changes. The opinion was expressed that in general the movement is gradually in favor of the general provisions for fertilizer legislation recommended by the association.

The committee on methods of teaching agriculture reported, through Dr. A. C. True, chairman, that 20,000 copies of last year's report of the committee on teaching agriculture in rural schools had been printed and distributed during the year. The committee desired in future to work along two main lines, viz, (1) to study courses of agriculture to

be taught in secondary agricultural schools and other high schools generally, and (2) to make a more detailed study of college courses in animal husbandry and develop some special topic of this subject from a pedagogical standpoint. Dr. True then explained the work of this Office in relation to agricultural education, pointing out the recognition it has received as a leading agency for the promotion of this branch of education, and the action of the Secretary of Agriculture in requesting from Congress an increased appropriation of $5,000 for the development of work along this line.

The committee on graduate study reported, through Prof. L. H. Bailey, chairman, that arrangements have been made for holding a second session of the school of graduate study at the University of Illinois during the coming summer. A canvass of the agricultural colleges for subscriptions of $25 a year toward the maintenance of the graduate school, as provided for by the association last year, showed 27 colleges favorable to making such subscription, 15 unfavorable, and 4 doubtful. The committee emphasized the importance of the graduate school, which it thought should be a regular and continuous work of the association. It held that the school should be an institution of the association, and that it should assume responsibility for its policy and management. The college where the school was held would then be the agent of the association. The sources of income for the graduate school would be (1) fees from the students, which it thought should be fixed at $10, (2) the contributions from the association, derived from the colleges subscribing, and (3) the contributions of the institution at which the course was given. The report of the committee, with its recommendations, was adopted.

The committee on pure-food legislation reported, through Dr. W. A. Withers, chairman, that progress had been made in extending and strengthening the State laws relating to foods, and also in the better execution of pure-food laws. It referred to the satisfactory workings of the inspection of imported foods as indicating the advantages of a national pure-food law.

The report of the committee on the collective college and station exhibit at St. Louis was presented by Dr. W. H. Jordan, chairman, and was received and the committee discharged. It was shown that of the $100,000 appropriated for this exhibit, only about $90,000 had been expended. The report gave a history of the origin and preparation of the exhibit, description of the various parts as installed, and of the so-called outside exhibit, together with other details. By vote of the association it was placed on file in the Office of Experiment Stations for future reference.

The report of the committee on indexing agricultural literature, presented by Dr. A. C. True, chairman, described the progress which has been made in the library of the Department of Agriculture in

indexing scientific periodicals relating to agricultural investigations and the preparation of cards which are printed by the Library of Congress.′ Thus far about 7,000 cards have been issued. At present there are only 10 subscribers for the complete sets and 11 for partial sets, and the question has arisen whether it is worth while to continue this work. It was pointed out that at least 35 subscribers for the complete index would be required to warrant its continuation. The undertaking was originally authorized by the association, and the members were therefore urged to investigate the character of the index to determine whether or not it should receive their future support.

The committee on rural engineering reported through Dr. W. E. Stone, chairman, that progress had been made in strengthening the courses in this subject at several institutions, but that sufficient importance had not been attached to this subject to give it a coordinate place with such subjects as horticulture, animal husbandry, agronomy, etc. It was believed that the best work could not be accomplished until this is done. The work of this Office in testing pumps, windmills, etc., was thought to be of material benefit to professors of rural engineering, as was also the work in irrigation and drainage. The committee believed there was need for a few institutions in the country to establish courses in rural engineering, and that that department should be of coordinate rank with such departments as agronomy, animal husbandry, etc.

Resolutions were passed indorsing the work of this Office along the lines of agricultural education, and also of irrigation and rural engineering.

Assistant Secretary W. M. Hays, for the committee on animal and plant breeding, reported the growth of the American Breeders' Association to an organization of about six hundred members, and the successful annual meeting held at Champaign, Ill., in February last. This committee was discharged, as it has accomplished the purpose for which it was organized.

The establishment of institutions for teaching and research work in forestry in connection with the land-grant institutions was discussed by Prof. S. B. Green, who introduced a resolution looking to national aid, and by Gifford Pinchot, of the Forest Service. As the association had decided to confine its efforts toward legislation as previously indicated, the resolution was laid upon the table.

President K. L. Butterfield offered a resolution instructing the executive committee to take steps to secure, if possible, the establishment of a department of rural agricultural education in the National Educational Association. The resolution was adopted. Hon. W. T. Harris, Commissioner of Education, made a brief address in which he expressed the view that agricultural education should be considered

each year in one of the special departments of the National Educational Association.

A vote of confidence and thanks was ordered sent to Representatives Adams and Mondell for their efforts in behalf of the bills in their charge for the further endowment of the experiment stations and the establishment of mining schools. The association also voted to lend its aid in support of national appropriation for the control of the gypsy moth. It went on record as indorsing the continuance of the collection and publication of data by the United States Department of Agriculture relative to the condition and yields of farm crops, for the use of farmers and for students in rural economics.

Invitations were received from California, Washington, and Louisiana for the association to hold its next annual meeting in these States. The telegrams from various parts of California were especially numerous, and much interest was manifested by the association in holding its next session in that State, in view of the meeting there of the National Educational Association next summer. The matter was left as usual in the hands of the executive committee.

In the election of officers M. H. Buckham, of Vermont, was chosen president; C. C. Thach of Alabama, E. H. Jenkins of Connecticut, J. H. Worst of North Dakota, B. I. Wheeler of California, and Luther Foster of New Mexico, vice-presidents; J. L. Hills, of Vermont, secretary and treasurer; and A. C. True, of this Office, bibliographer; executive committee, H. C. White of Georgia, J. L. Snyder of Michigan, W. H. Jordan of New York, C. F. Curtiss of Iowa, and L. H. Bailey of New York.

In the section on college work and administration, C. R. Van Hise, of Wisconsin, was chosen chairman, and H. C. Price, of Ohio, secretary.

B. C. Buffum, of Wyoming, was elected chairman of the section on experiment station work, and M. A. Scovell, of Kentucky, secretary.

H. P. Armsby of Pennsylvania, C. F. Curtiss of Iowa, and the secretary of the section (ex officio) compose the programme committee of the latter section.

SECTION ON COLLEGE WORK AND ADMINISTRATION.

The general theme for discussion in this section was The Field and Functions of the Land-Grant Colleges, which was considered under the three heads—curriculum, discipline, and environment.

In a paper on A Minimum General Culture Requirement, President A. B. Storms held that the students which the land-grant colleges attract are not prepared for severely technical courses, and hence provision should be made for general culture studies during the first two years of the course, with opportunity for election in the last two years. The students should not be occupied in acquiring mere manual dexterity, which can be more cheaply learned in the workshop.

President J. M. Hamilton discussed the Relative Amounts of Pure and Applied Science. He held that the land-grant colleges should give a good foundation in pure science, not for intellectual training alone, but as a preparation for the work in applied science. There should be diversity in this also, for the application of pure science frequently calls for the union of several branches. In view of these considerations he would have a large amount of pure science work in the early part of the land-grant college course, and make the later science work thoroughly industrial.

Prof. F. W. Rane, in his discussion of Courses in Agriculture, Horticulture, and Allied Subjects, confined his remarks mainly to horticulture. In his scheme for utilizing the 150 hours assigned to horticultural courses, 20 hours were given to the study of propagation, 50 to pomology, 50 to olericulture, and 30 to floriculture. Charts were also exhibited which showed a syllabus of a separate course in horticulture, and of horticulture as it is now given in several States.

Dr. H. W. Tyler discussed what constitutes a "liberal and practical education" for an engineer, making suggestions as to the allotment of time between general science and professional work; and Dr. W. E. Stone and President J. L. Snyder considered the desirability of degree courses in home economics. The former held that since the manual operations of this country are performed by the uneducated people, there is no place for manual training in the degree courses, but that skill in manual operations should be acquired in the lower schools. President Snyder maintained that manual development might to a certain extent be considered one of the legitimate aims of a college course, which ought to be in the broadest sense a preparation for life; and he outlined a tentative degree course in home economics.

In discussing these papers Prof. L. H. Bailey pointed out a tendency to react from the exclusively or severely technical undergraduate courses, and to hold somewhat closely to some of the traditions of education. He noted further a growing disposition to occupy the first two years of the college course with the fundamental or pure science subjects, a drift of opinion toward humanizing the conduct of courses in all of the land-grant institutions, and "an increasing sympathy with the work-a-day life," a desire to introduce other subjects which have to do with the every-day life of the people, and a general indication that the courses, particularly on the agricultural side, are not regarded as severely technical. Particularly was he impressed with the emphasis placed upon the ideals of education rather than practical utility.

Student Control was the topic of a paper presented by President W. O. Thompson, who discussed (1) student government as originated at the University of Illinois in 1869, and tried subsequently at a number of other institutions; (2) faculty control, and (3) administrative

control. He favored the latter method, which places the matter of discipline entirely in the hands of the president of the college and does away with the necessity for elaborate rules and regulations. The discussion following seemed in general to favor this view.

In discussing the relation of the land-grant colleges to the State universities, President W. J. Kerr stated that since 1862, in response to a demand which found its first concrete expression in the land-grant act, the courses in the State universities have been greatly modified, the changes being toward "education related more directly to the practical affairs of life." The logical division of work in the States having separate institutions he thought would be for the universities to offer courses in liberal arts and the professions, while the land-grant colleges would offer all of the technical courses in agriculture and the mechanic arts.

In a paper on The Normal Schools, President K. C. Babcock brought out the fact that comparatively little is now being done to train teachers for small towns, villages, and rural communities. He urged that the land-grant colleges should help the normal schools by offering short courses for teachers, holding institutes, and sending out their officers to give courses and lectures in normal schools. The same general conception of the duty of the land-grant colleges in the movement for the improvement of public schools was held by Dr. A. C. True, who read a paper on The Public Schools. He said that the colleges should study the programmes of the public schools, come into close touch with their school officers and teachers, provide courses of study which will be attractive to school officers and teachers, and by summer schools or otherwise seek to bring such persons into direct contact with the system of education represented in these colleges. Elementary and secondary courses in agriculture and mechanic arts in the public schools are required to direct students to the land-grant colleges and to prepare them to enter their courses.

Prof. John Hamilton discussed the relation of the land-grant colleges to the farmers, and pointed out three great fields in which these institutions should work, viz, (1) the college class room—four-year courses, short courses, and post-graduate courses; (2) college extension work, including correspondence courses, farmers' institutes, movable schools of agriculture, and practice farms, and (3) normal schools of agriculture for training capable farmers to take part in the extension work of the colleges.

SECTION ON EXPERIMENT STATION WORK.

The two subjects arranged by the programme committee for consideration in this section were (1) soil investigations and (2) how much demonstration work and what kind should the experiment station undertake?

Under the first subject Dr. C. G. Hopkins presented a paper on Soil Fertility in Relation to Permanent Agriculture, in which he called attention to the widespread decline of the fertility of farm lands in the United States, due to exhaustive systems of cropping and export of fertility from the farm. The extension of animal husbandry, involving the feeding of a large proportion of the crops grown to animals on the farm, and thus insuring the return of the fertility to the soil, would act as a partial check to this exhaustion; but it was pointed out that about 80 per cent of the farmers of the United States are giving attention almost exclusively to crop production, and that a large proportion of them will probably never take up animal production to an extent that will result in an increase of fertility of their farms in this way. It is therefore necessary for such farmers to adopt systems of cropping, supplemented by the use of fertilizers, which will enable them to maintain the balance of fertility or turn it in their favor.

The experiments of the Illinois Station with various systems of cropping and fertilizing on different soil horizons, on representative Illinois soil areas and types, were briefly reviewed, the results of chemical analysis and pot and field experiments usually agreeing in showing that in these soils phosphoric acid is usually the principal requirement and the only one which needs to be applied in commercial form. The soils are, as a rule, abundantly supplied with potash, and nitrogen is readily and cheaply obtained by growing leguminous plants. The cheapest and most efficient means of supplying the phosphoric acid has been found to be by the use of fine-ground rock phosphate in connection with green manures or other materials supplying abundance of decaying organic matter. The efficiency of such cheap phosphates as compared with the more expensive acid phosphates has also been demonstrated at the Maryland, Ohio, and Pennsylvania stations.

In the discussion following this paper, Director C. E. Thorne pointed out the fact that virgin soils and those long under cultivation behave very differently toward the same systems of cropping and manuring; Dr. H. J. Wheeler called attention to the unsuitability of untreated phosphates to exhausted soils and to market-garden crops; and Prof. W. P. Brooks stated that a large proportion of the soils of New England are in special need of potash, and that it is impossible to determine the fertilizer requirement of a soil apart from the peculiar needs of the particular crop to be grown, a fact which was strongly emphasized by other speakers.

In a paper by Dr. A. M. Peter on Some Results of an Old Method for Determining Available Plant Food in Soils, read by the secretary of the section, a compilation was given of the results of determinations, made in 1854 by R. Peter, State geologist of Kentucky, of the

relative solubility of the constituents of virgin soil, old field soil, and subsoil in carbonated water (saturated with carbon dioxid under a pressure of two atmospheres). The averages of 33 determinations in each case showed the greatest solubility in case of the virgin soil and least in case of the subsoil. The variable character of the carbonated water and its low solvent power for phosphates are considered insuperable objections to its use for this purpose. The author recommended one-fifth normal nitric acid, and reported comparative studies of the solubility in this acid of the potash, phosphoric acid, and lime of good and poor tobacco soils and of pasture soil, as well as of the first two in hydrochloric acid of 1.115 sp. gr. The results showed a small percentage of available potash, but very large amounts of available phosphoric acid and lime, in all soils and to all depths down to 2 feet. Incidentally it was found that the poor tobacco soil was much richer in nitrates than the better soil. Methods of sampling soils were briefly discussed, and the concentrating of attention on the first 6 inches of soil as that part of most importance in plant production was advised.

Director C. E. Thorne presented a paper on Soil Investigation, in which he pointed out the necessity of supplementing chemical analysis and pot experiments with carefully conducted field experiments, and also of giving more attention to the biological processes in the soil. The results of a 7-year rotation with corn, oats, and wheat, and of a 3-year experiment with clover, at the Ohio Station, using lime and various fertilizer combinations, were reviewed, showing that phosphoric acid is apparently the first requirement of cereals on the soils experimented with, and lime the first requirement of clover, potash being second in importance for this crop. The beneficial effect of the lime, particularly on the clover crop, was apparently due to the acid condition of the soil, the character of the growth of the clover being a reliable index of the acidity and the need of lime. Such acid soils were shown to be widely distributed in Ohio.

Attention was called to the fact that the action of certain forms of nitrogen, particularly ammonium sulphate, on acid soils is greatly improved by applications of lime. It was also noted that plants vary with reference to sensitiveness to soil acidity, wheat being especially resistant. While the source and nature of the soil acids are not well understood, there are indications that they may be, in part at least, the result of biological processes.

Discussing this paper, Dr. J. G. Lipman urged the importance of more careful study of the relation of acidity to bacterial activity on the one hand and to the physiological processes of the plant on the other, especially as affecting the solubility of the nitrogen compounds present in the soil or diffused from the cells of the plant roots or the root tubercles.

Dr. H. J. Wheeler made some suggestions regarding profitable lines of research in connection with soils, including study of chemical means of differentiation of the forms of phosphoric acid in soils, influence of soil treatment on the biological processes of the soil and the growth of plants, maximum limits of application of lime, influence of the growth of one plant upon the growth of its successor upon the same soil, influence of soil texture upon the growth of different plants, availability of plant food, the relative avidity with which different plants take up soil potash and soda, and the reliability and applicability of Loew's hypothesis regarding a necessary fixed ratio between lime and magnesia in productive soils.

In the discussion of the subject of demonstration work, Director Thorne explained the Ohio system of (1) test farms on which experimental work is carried on in different parts of the State; (2) cooperative experiments with farmers, taking up simpler phases of station work, and intended primarily to develop farm experimenters in each locality, and (3) special arrangement for particular pieces of work. Some features of the work done under this system are experimental and in part maintained by Federal funds; a large part is purely demonstration work and is maintained by State funds provided for that specific purpose. The importance in cooperative work of relieving the farmer from pecuniary responsibility and of maintaining strict supervision of the work through station officers was pointed out. The speaker urged the need of extension of demonstration work.

Dr. Hopkins explained the system of combined experimental and demonstration work followed in Illinois on the farms controlled by long-time lease or purchase on the various typical soil areas of that State. Prof. L. C. Corbett drew a sharp distinction between experimental work and demonstration work, holding that the latter should have as its prime object the teaching of remunerative methods of farming, as illustrated in the work of the Department demonstration farms in the cotton belt. Similar views were expressed by Director C. D. Smith, who cited various illustrations of ways in which the station had been instrumental in introducing more profitable farm practices in Michigan by means of demonstration experiments.

Dr. W. H. Jordan, of New York, thought that agricultural knowledge passed through three stages in reaching the farmer, (1) laboratory investigation, (2) test in practice, (3) general introduction. Experimental work ends with the second stage. The third is purely demonstration work, and is not the province of the stations under the Hatch Act. Director Hills, of Vermont, thought discovery to be the primary object of the stations, and that demonstration work was outside their province. Dr. Wheeler believed the discovery and test in practice of scientific truth the proper functions of the station. The dissemination of results by demonstration and like means he held to

be an educational function and to belong properly to the extension departments of the colleges. Prof. T. F. Hunt urged that more attention should be given to the study of agricultural economics, so that there will be a better basis for advice as to business methods and management on the farm.

Prof. W. J. Spillman maintained that the purpose of demonstration farms should be to teach profitable methods of farming, based upon scientific investigations and the experience of successful farmers. Demonstration work is a necessary supplement of the present system of investigation and dissemination. He briefly explained some features of the work of the Department in farm management. Dr. H. P. Armsby warned against encouraging exaggerated expectations on the part of farmers from experiment station work. The farmer should be encouraged as far as possible to work out the problem of farm management for himself, a view which was concurred in by others.

A report on the federation of agricultural organizations in different States of the Union was submitted by Dr. H. J. Wheeler. This paper showed that in 12 States federation has already been secured and that other States are contemplating federation. The report was accepted and the committee continued.

A preliminary report on the unification of terms for reporting analytical results was submitted by Dr. C. G. Hopkins, chairman of the committee on this subject. The report contained unanimous recommendations with regard to terms to be used in reporting analyses of feeding stuffs, foods, sugars, and insecticides, but the committee was unable to agree as to terms to be used in soil and fertilizer analysis, the disagreement being with regard to the use, proposed by Dr. Hopkins, of the "element" system of nomenclature.

Prof. H. Snyder presented the report of the committee on testing cereals, which noted the limited character of the literature relating to the testing of wheat and flour for industrial purposes, and discussed briefly some of the factors which have been shown to control flour yield and bread-making quality. Flour yields have been shown to be directly proportional to weight per bushel, but bread-making quality does not follow the same rule. Color and hardness are controlling factors in determining commercial value of wheat for milling purposes. There are many unsettled points in connection with the relation of the amount and character of the protein to bread-making quality. The committee proposes to take up first methods of preparing flour for test. The report was accepted and the committee continued.

The main general topic proposed for discussion by the section at the next convention was Animal Nutrition, but the opinion seemed to generally prevail that the officers of the section and the programme committee should be left free to change the topics if contingencies should arise which would make it desirable to do so.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Methods of titration of phosphoric acid, O. J. HLAVNICKA (*Ztschr. Angew. Chem., 18 (1905), pp. 655, 656; abs. in Analyst, 30 (1905), No. 352, pp. 257, 258*).—The author describes what he considers to be a simple and practical modification of Hundeshagen's method. The phosphoric acid is precipitated as magnesium-ammonium phosphate by the citrate method, the precipitate collected on a hardened filter paper, washed first with 2½ per cent ammonia and then with alcohol until free from ammonia, the total volume of the washings not exceeding about 40 cc. "The precipitate is then washed off with cold water into a porcelain dish (total volume required about 200 cc.), and, after the addition of a few drops of methyl orange solution (strength, 0.1 per cent), decomposed with a slight excess of $\frac{3}{10}$-normal HCl, and the excess found by titration with $\frac{3}{10}$-normal NaOH (1 cc. $\frac{3}{10}$-normal acid=0.01065 gm. P_2O_5)."

A rapid volumetric method for the determination of phosphoric acid, W. B. HIRT and F. W. STEEL (*Proc. Soc. Chem. Indus. Victoria, 1905, Mar.-Apr.; Chem. News, 92 (1905), No. 2389, pp. 113, 114*).—A slight modification of Littmann's method (E. S. R., 10, p. 513) is described and recommended as preferable to Pemberton's method for commercial work.

Solubility of lime and magnesia in solutions of sodium chlorid with or without sodium hydroxid.—Application to the separation and estimation of the two substances, E. MAIGRET (*Bul. Soc. Chim. Paris, 3. ser., 33 (1905), No. 11, pp. 631-634, figs. 2; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 513, II, p. 482*).—The author makes use of the fact that while lime is fairly soluble, magnesia is insoluble in solutions containing less than 160 gm. per liter of sodium chlorid in presence of 0.8 gm. per liter of sodium hydroxid in extending and making more accurate D'Anselme's method of estimating lime and magnesia.

The method proposed by the author is as follows: To 100 cc. of the solution in a 200 cc. flask add 20 cc. of a solution containing sodium carbonate, 100 gm., and sodium hydroxid, 20 gm., per liter, the equivalent of which in 2-normal hydrochloric acid is known. Heat the mixture to boiling, cool, and make up to 200 cc. with a solution of sodium chlorid, 160 gm. per liter. Shake the mixture, filter, and titrate 100 cc. of the filtrate with 2-normal hydrochloric acid, using tropeolin as indicator. The difference between twice the burette reading and the equivalent of the alkaline solution added gives the total magnesia and lime present in terms of 2-normal hydrochloric acid.

To determine magnesia alone add to 100 cc. of the solution 10 cc. of a solution of sodium hydroxid, 80 gm. per liter; dilute to 1 liter with a solution of sodium chlorid, 160 gm. per liter; shake, filter, and titrate 500 cc. of the filtrate with 2-normal hydrochloric acid, using phenolphthalein as indicator. The difference between the burette reading multiplied by 2 and the amount of sodium-hydroxid solution added gives the magnesia present. The difference between this and the first determination gives the lime present.

On the determination of nitrogen by the Kjeldahl method, S. P. L. SORENSEN, C. PEDERSEN, and A. C. ANDERSON (*Compt. Rend. Lab. Carlsberg, 6 (1905), No.*

3, pp. 126–136, 193–208; abs. in Analyst, 30 (1905), No. 354, pp. 314, 315).—The applicability of the Kjeldahl method to the determination of nitrogen in such compounds as creatin, creatinin, lysin, and uric acid is discussed and precautions to be observed to secure accuracy are explained.

A modification of the Kjeldahl method for the determination of total nitrogen in urine, A. BABES (*Bul. Pharm. et Chim. Roumanie, 1905, May–June; abs. in Ann. Chim. Analyt., 10 (1905), No. 9, p. 366*).—In the method proposed 2 to 5 cc. of urine is digested in a 100 cc. flask with 2 cc. of hydrogen peroxid, 0.1 to 0.15 gm. of sodium oxalate, and 1 to 1.5 cc. of concentrated sulphuric acid. The time of digestion never exceeds 1½ hours. Sodium hydroxid may be added and the nitrogen determined in the usual way, or it may be determined volumetrically by means of sodium hypobromite.

Volumetric determination of nitrous acid by means of ceric sulphate, G. BARBIERI (*Chem. Ztg., 29 (1905), pp. 668, 669; abs. in Analyst, 30 (1905), No. 354, p. 320*).—The nitrite is oxidized to nitrate by the addition of an excess of ceric sulphate, the excess of the latter being decomposed by the addition of potassium iodid and the liberated iodin titrated as usual.

On the determination of ammonia in water, CAVALIER and ARTUS (*Bul. Soc. Chim. Paris, 33 (1905), pp. 745–747; abs. in Analyst, 30 (1905), No. 354, p. 319*).—From the results of a series of experiments the authors conclude that the iodid method of Trillat and Turchet (E. S. R., 17, p. 112) is less sensitive than that of Nessler, no coloration being perceptible until the proportion of ammonia is as much as 3 mg. per liter. This necessitates, in case of water containing small amounts of ammonia, evaporation which is as tedious as the distillation in the Nessler process. It was also found that the black coloration of the iodid was very unstable and disappeared almost completely after 2 or 3 minutes.

Determination of the organic nitrogen in potable waters, J. C. BROWN (*Proc. Chem. Soc. London, 21 (1905), pp. 208, 209; abs. in Analyst, 30 (1905), No. 354, p. 316*).—"Details are given of a process for the determination of the whole of the organic nitrogen in water and sewage effluents. The process essentially consists in the distillation to dryness and subsequent ignition of a mixture of a portion, usually 200 cc., of the sample, without previous evaporation, with potassium hydroxid and potassium permanganate. The operation is carried out either in a Jena glass or in a copper retort, and the evolved ammonia is determined by Nessler's reagent as usual."

Report of committee on standard methods of water analysis to the laboratory section of the American Public Health Association (*Jour. Infect. Diseases, 1905, Sup. 1, May, pp. 1–141*).—This is the report made to the laboratory section at the Havana meeting of the American Public Health Association, January 9, 1905, outlining the progress in water analysis and describing the best current practice. The report is based on the results of 5 years' cooperative work on the part of several of the most active water analysts and bacteriologists of the country and covers in great detail the whole field of water analysis, physical, chemical, microscopical, and bacteriological, including under the latter a revision of the report of the bacteriological committee of the American Public Health Association published in 1897.

"The methods of analysis presented in this report as 'standard methods' are believed to represent the best current practice of American water analysts, and to be generally applicable in connection with the ordinary problems of water purification, sewage disposal, and sanitary investigations. . . . Detailed descriptions of the various methods recommended are given in concise form, covering the essential features of each determination. It is assumed that those using these directions are thoroughly grounded in the fundamental principles of chemistry and biology, and that they are also familiar with the leading literature upon the subject."

The report brings out quite sharply the limitations which have been placed on purely chemical determinations such as "free ammonia" and "albuminoid ammo-

nia" by recent investigations and the greatly increased importance of biological and physical examination, the last rendered necessary by recent progress in methods of precipitation, sedimentation, and water softening.

A bibliography is given containing "a list of references to the works most consulted in America, arranged for the purpose of assisting the reader in getting in touch with the general aspects of a method, including its history and application, together with full technical details of the procedure as now practiced.

"No attempt is made to report upon the interpretation of the results of water analyses or upon the classification of bacteria, as these subjects are receiving the attention of other committees of the association."

Progress in the chemistry of waters, including natural and artificial mineral waters, A. GOLDBERG (*Chem. Ztg.*, *29* (*1905*), *No. 70*, *pp. 915–921*).—A brief review of investigations relating to this subject, with numerous references to literature.

The volumetric determination of reducing sugars, A. R. LING and T. RENDLE (*Analyst*, *30* (*1905*), *No. 351*, *pp. 182–190*).—Ferrous thiocyanate has been found by the authors the most satisfactory indicator for titrating sugars with Fehling's solution.

The indicator is prepared by dissolving 1 gm. of ferrous ammonium sulphate and 1 gm. of ammonium thiocyanate in 10 cc. of water at a temperature of about 45 to 50° C., cooling the solution, and adding 50 cc. of concentrated hydrochloric acid. The solution is decolorized by the addition of a little zinc dust. The Fehling's solution is not diluted. The sugar solution should be of such a strength that 20 to 30 cc. will reduce 10 cc. of Fehling's solution.

A study of the hydrogen peroxid method of determining formaldehyde, J. K. HAYWOOD and B. H. SMITH (*Jour. Amer. Chem. Soc.*, *27* (*1905*), *No. 9*, *pp. 1183–1188*).—The methods of Blank and Finkenbeiner and of Fresenius and Grünhut served as a basis for the tests reported. A modified procedure for carrying out the former method is suggested.

A new method for the detection of formalin in milk, UTZ (*Chem. Ztg.*, *29* (*1905*), *No. 49*, *p. 669*).—Unless added to milk in larger quantities than are necessary for the purposes of preservation, formaldehyde was not found to interfere with the tests used to distinguish boiled from raw milk.

Winckel's test for enzyms was found very delicate for detecting formaldehyde in milk. Equal parts of milk and hydrochloric acid, sp. gr. 1.19, are heated with a crystal of vanillin, when a violet or raspberry color shows the presence of formaldehyde, a faint trace, however, being indicated by a yellow color. The author found that piperonal or p-oxybenzaldehyde could be substituted for the vanillin, though not with quite so satisfactory results. This method of detecting formaldehyde was not found applicable to other food products than milk.

New method of rapid milk analysis, F. BORDAS and TOUPLAIN (*Ann. Chim. Analyt.*, *10* (*1905*), *No. 7*, *pp. 267*, *268*; *Rev. Soc. Sci. Hyg. Aliment.*, *2* (*1905*), *No. 2*, *pp. 163–168*).—Ten cc. of milk is added drop by drop to 25 cc. of 65 per cent alcohol acidified by acetic acid in a weighed sedimentation tube. After standing for a few moments this is centrifuged, the supernatant liquid decanted, and the precipitate washed twice in 50 per cent alcohol, using 30 cc. for this purpose.

Lactose is determined in the liquid obtained by means of Fehling's solution. Fat is determined by extracting the precipitate with alcohol and ether, centrifuging, and again extracting with ether, the decanted liquids being collected in a tared dish, evaporated, and the fat weighed. The casein remaining in a fine powder in the original sedimentation tube is then dried and weighed, after which it is incinerated and the ash determined.

New method of milk analysis, J. BELLIER (*Ann. Chim. Analyt.*, *10* (*1905*), *No. 7*, *pp. 268–276*).—In the gravimetric method described the absorbent material used is a medium fine sponge previously cut into small pieces and prepared by treating suc-

cessively with dilute hydrochloric acid, alcohol, ether, and water, and drying. The weight of the sponge then remains practically constant, the maximum loss in the subsequent operations being placed at 1 mg. The piece of sponge is weighed, moistened with distilled water, and made to absorb 5 cc. of milk. It is then dried at 80° C. to a constant weight, 3 hours being generally sufficient.

The total solids are then ascertained by loss in weight. The fat is then extracted in a Soxhlet apparatus and also determined by the loss in weight. The sponge containing the solids-not-fat is then subjected to fumigation with formaldehyde gas to render the proteids insoluble, and is then thoroughly washed with 50 per cent alcohol containing 5 per cent acetic acid and with distilled water to remove the milk sugar and mineral matter. The sponge is then dried and weighed, the loss in weight representing the proteids and also about 2 mg. of ash for an original sample of 5 cc. of milk. Ash is determined on a separate sample and milk sugar calculated by difference.

Analyses by the method described are given of 7 samples of cow's milk and a number of samples of human milk from normal and diseased subjects.

Chemical analysis and cryoscopy of milk, H. LAJOUX (*Ann. Chim. Analyt.*, *10* (*1905*), *No. 6*, *pp. 219–231*).—Cryoscopic determinations were made on 24 samples in the municipal laboratory at Reims.

The freezing point averaged about −0.55° C. and was apparently not influenced by the kind of food, the breed of cows, nor the density and fat content of the milk. The freezing point is, however, affected by the addition of water, and it is for the detection of this that the method is considered a valuable supplement to chemical analysis. For market milk a legal standard of 0.55 to 0.57° is suggested. For individual cows the freezing point may exceptionally be 0.54°. A freezing point between − 0.55 and 0° would, therefore, serve to indicate approximately the proportion of water added, bearing in mind, however, that pathological conditions of the milk or the addition of soda or other substances may affect the reading.

The Sichler "sin-acid" butyrometry, W. SCHNEIDER (*Chem. Ztg.*, *29* (*1905*), *No. 51*, *p. 690*).—Comparative tests of the Gerber and Sichler methods were made on goat's milk and cow's milk during a period of 6 months. In its present form the Sichler method is not considered equal to the Gerber method.

Sulphuric acid for the determination of milk fat by the Gerber method, M. SIEGFELD (*Molk. Ztg.*, *19* (*1905*), *No. 29*, *p. 758*).—While pure acid is not necessary for this purpose, badly contaminated acid was found to be very unsatisfactory.

The estimation of fat, L. LIEBERMANN (*Arch. Physiol.* [*Pflüger*], *108* (*1905*), *No. 10–12*, *pp. 481–488*).—According to the author, simple extraction with alcohol and ether does not give results which are comparable with the saponification method, unless the alcohol extraction is continued for days. Indeed, a complete extraction of the fat is hardly possible.

The estimation of fat in infant and invalid foods, C. B. COCHRAN (*Jour. Amer. Chem. Soc.*, *27* (*1905*), *No. 7*, *pp. 906–909*).—The method proposed consists in treating the sample of milk or milk products under suitable conditions with equal volumes of 80 per cent acetic acid and concentrated sulphuric acid, warming until the substance turns a coffee color, cooling, mixing with a small amount of ether, and heating with hot water until the ether vapor is removed. The layer of supernatant fat can then be measured and the proportion of fat calculated from the amount of material used.

The use of the centrifuge in the analysis of cocoa and chocolate, F. BORDAS and TOUPLAIN (*Rev. Soc. Sci. Hyg. Aliment.*, *2* (*1905*), *No. 1*, *pp. 92–110*).—Methods of analyzing cocoa and chocolate are described and analyses reported. The use of a centrifugal machine for determining fat and materials insoluble in water and insoluble in a mixture of water, alcohol, and ether is recommended. According to parallel determinations, the centrifugal method for determining fat (ether, carbon disulphid,

and gasoline being used as solvents), gives as satisfactory results as the Soxhlet extraction method.

The influence of atmospheric oxidation upon the analytical constants of fatty oils, H. C. SHERMAN and M. J. FALK (*Jour. Amer. Chem. Soc., 27 (1905), No. 5, pp. 605–608*).—Data are given for correcting the iodin number of oxidized fatty oils on the basis of the original specific gravity, or if this is not known on the average specific gravity of the oil under consideration.

Analysis of the Mexican plant Tecoma mollis, L. F. KEBLER and A. SEIDELL (*U. S. Dept. Agr., Bur. Chem. Circ. 24, pp. 6*).—Analyses by the methods of Dragendorff and Parsons were made of this plant, which is reported as extensively used in certain parts of Mexico in the treatment of disease.

The examination failed to reveal the presence of any alkaloid or other well-characterized constituent of medicinal importance. The virtues attributed to this plant are believed to be associated in some way with bitter ingredients which it contains. As applied to this material the Dragendorff method of analysis was considered preferable to the Parsons method.

Agricultural chemistry in the year 1904, W. ZIELSTORFF (*Chem. Ztschr., 4 (1905), Nos. 8, pp. 178–182; 9, pp. 198–202; 10, pp. 219–222; abs. in Chem. Centbl., 1905, I, No. 26, p. 1729*).—A review of the literature of investigations (mainly European) during the year relating to the nutrition of plants and animals.

METEOROLOGY—WATER.

Summary of weather data, 1894–1904, G. A. CROSTHWAIT (*Idaho Sta. Bul. 49, pp. 7, 8*).—Monthly and annual summaries of observations during 11 years, 1894–1904, on temperature and precipitation at Moscow, Idaho. The mean temperature for that period was 46.6°, the annual precipitation 22.11 in. The mean temperature of 1904 was 48.6°, the precipitation 15.39 in.

Weather data, 1903–4; summary for eleven years, 1894–1904, G. A. CROSTHWAIT (*Idaho Sta. Circ. 1, pp. 28, map 1*).—This bulletin is a collection of tables giving daily and monthly summaries of observations at Moscow during 1903 and 1904 on temperature, atmospheric pressure, precipitation, cloudiness, and wind movement. Summaries of observations on temperature and precipitation during 11 years at the same place are also given, as noted above.

Meteorological observations, J. E. OSTRANDER and C. H. CHADWICK (*Massachusetts Sta. Met. Buls. 199, 200, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during July and August, 1905. The data are briefly discussed in general notes on the weather of each month.

Meteorological observations, G. GINESTOUS (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 36, pp. 452–463*).—Tabular summaries are given of observations during March, April, and May, 1905, at a number of places in different parts of Tunis on precipitation, temperature, atmospheric pressure, humidity, evaporation, cloudiness, direction of the wind, and casual phenomena.

Meteorological and magnetic observations at the observatory of the College of Belen of the Society of Jesus, Havana, during the year 1904, L. GANGOITI (*Observaciones meteorologicas y magneticas hechas en el observatorio del Colegio de Belen de la Compañía de Jesus en la Habana, año de 1904. Havana: Avisador Comercial, 1905, pp. 74*).—A detailed report largely tabular and diagrammatic of the usual meteorological observations.

Meteorology of New Zealand: On the routes of high and low pressures, and the changes of pressure and wind movement resulting from them, R. A. EDWIN (*Trans. and Proc. New Zeal. Inst., 37 (1904), pp. 555–567, figs. 7*).—This arti-

cle gives a general discussion of the principles upon which atmospheric movements depend, especially the theory of the mechanical principle of atmospheric circulation, and defines "certain systems of pressure, their wind movements and routes."

Barometer and weather, van Bebber (*Arch. Deut. Seewarte, 27 (1904), No. 2, pp. 1-15; abs. in Science, n. ser., 22 (1905), No. 550, p. 54*).—The author discusses the use of the barometer in weather forecastings, refers to studies along this line, and traces the relation between barometer readings at Hamburg and the rainfall, temperature, and cloudiness for the year, for different seasons, and for individual months during the period 1876-1900.

A close relation between rainfall and falling barometer is shown. The average yearly temperature departures were negative at the higher pressures and positive at the lower. At low pressures the departures are positive in winter and negative in summer. In general the author concludes that a reasonably accurate judgment of existing and coming weather can be based on barometer readings, especially when the location of cyclonic and anticyclonic centers are shown.

An experience of 25 years leads the author to the conclusion "that no reorganization of weather-service work would be of any value if the present forecasts for a single day following are adhered to. These forecasts have not satisfied the agricultural interests, and will not satisfy them in the future. Nor will the forecasts be satisfactory unless the general public understands better than at present the basis on which weather predictions rest."

Investigation of the upper atmosphere by means of kites in cooperation with a committee of the Royal Meteorological Society, W. N. Shaw et al. (*Rpt. Brit. Assoc. Adv. Sci., 1904, pp. 17-20*).—This is a report of progress in a continuation of the investigations of this committee which have been previously noted (E. S. R., 15, p. 125). The observations here outlined were made in the summer of 1903, their object being "to ascertain if the behavior of the kites could be improved by alteration of shape, size, etc., more particularly with regard to uniformity of pull and stability in winds of varying force."

The general movements of the atmosphere in winter, P. Garrigou-Lagrange (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 4, pp. 283-285*).—The author briefly describes the results of an attempt to trace the general atmospheric movement of the entire northern hemisphere, especially during the winter of 1882-83, by superposition of daily barometric charts.

The use of cannons and bombs as a means of protection against hail, H. Dufour (*Chron. Agr. Vaud, 18 (1905), No. 14, pp. 330-334*).—The results obtained in the use of this method during 1902, 1903, and 1904 are briefly reviewed, the general conclusion being reached by the author that while results are not decisive they furnish some encouragement for the continuance of the practice.

It is pointed out, however, that, apparently, viticulturists have more confidence in the method than scientists, but that meteorologists are at variance in their opinions on the subject, one class denying absolutely the efficiency of the process, another holding that the results claimed are not explicable in the present state of science, and therefore require a long series of observations before final judgment can be rendered.

The water supply: Bacteriological examination of water from ponds, tanks, and cisterns, L. L. Lewis et al. (*Oklahoma Sta. Bul. 66, pp. 26, figs. 4*).—This bulletin reports work which was undertaken in order to obtain data showing the relative number of bacteria in water from ponds, tanks, and cisterns under conditions similar to those existing when the water is in use, special attention being given to the variations in the bacterial content of two small ponds such as are commonly used in Oklahoma as a source of water supply for farm animals.

The results of the bacteriological examinations show that the water from the ponds contained as a rule less bacteria than that of the tanks filled with pond water or from wells. The pond receiving drainage from the barn lots, and to which the cattle had

free access, showed a higher bacterial content than that which was fenced and received drainage from pasture land. The number of bacteria in the pond water was high after heavy rains and rapidly fell with clear weather. "Two conditions contribute to this purifying process in ponds, sunshine and sedimentation, the latter having a much greater influence in purifying the water than the former." As a result of such purification in the pond, which was fenced so that the water was not disturbed by stock, the actual number of bacteria present in the surface water was less than in some of the wells examined. The number of bacteria in the tanks was much higher than in the water of the wells from which they were filled, showing "that any water, however pure, when pumped from a well will soon show a large number of bacteria when sampled from a tank, on account of the trash, dirt, etc., that will accumulate in the tank, as well as from the saliva of animals drinking the water."

Attention is called to the danger of the spread of intestinal parasites through the agency of pond water. "If any of the stock are infested with worms the water from pastures collected into ponds soon becomes contaminated with the eggs and larvæ, and in this way are transferred to the alimentary canal of other animals, where they develop."

The methods of bacteriological examination used, of building ponds and cisterns, and of protecting them from contamination are described.

Miscellaneous water analyses, A. G. FORD (*Oklahoma Sta. Bul. 67, pp. 18*).—The results of partial analyses of 126 samples of water made at the station during the past 5 years are reported and discussed. Of these, 95 samples were from wells, 13 from springs, 5 from rivers or creeks, 2 from cisterns, and 11 miscellaneous. The methods used in analysis and in the interpretation of results are briefly explained, and methods of protecting water from different sources from contamination are described.

Filtration and sterilization of water, H. PILLAUD (*Jour. Agr. Prat., n. ser., 10 (1905), Nos. 30, pp. 109–111; 38, pp. 373–375, fig. 1*).—Apparatus and systems (thermal, chemical, and physical) for this purpose suitable for use on farms are described and tests of the efficiency of some of them are briefly reported.

The action of cupric sulphate upon the bacterial life contained in water, H. WATKINS-PITCHFORD (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 8, pp. 775–782*).—A series of tests of Moore's method (E. S. R., 16, p. 238) is reported, which leads to the conclusion that "in the sulphate of copper, used in proportions of 1 part of the salt to 75,000 parts of water, we possess an agent which promises to be both valuable and safe." Practical trials of the method on a large scale in purification of South African water supplies are advised.

Use of barium carbonate for the purification of water, E. E. BASCH (*Chem. Ztg., 29 (1905), No. 53, pp. 721, 722; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 514, II, p. 515*).—Experiments on a small scale are reported, in which barium carbonate used in excess and thoroughly mixed with the water was found to be an effective means of reducing hardness.

The barium carbonate precipitates lime as carbonate and sulphuric acid as sulphate. It thus has a decided advantage over the ordinary method of using caustic lime to remove temporary hardness due to bicarbonates of lime and magnesia, and sodium carbonate to remove permanent hardness due to sulphates of these bases, since in this process sodium sulphate is formed which remains in solution with sodium chlorid and is objectionable for a number of reasons. The barium carbonate, however, acts slowly on account of its low solubility in water. For this reason apparatus has been devised which keeps the carbonate stirred up in the water and thus hastens its action.

Thirty kg. of barium carbonate to 10,000 liters of water daily, with the addition of 15 kg. every 14 days, is considered a sufficient amount for the treatment of ordinary waters. The precipitated slime may be partly removed from time to time, but it is

considered best to allow it to accumulate in considerable quantity since precipitation is more complete in its presence.

Purification and sterilization of drinking water by means of calcium peroxid, L. Freyssinge and R. Roche (*Rev. Internat. Falsif., 18 (1905), pp. 49–51; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 514, II, p. 515*).—It is stated that water can be completely sterilized by adding 0.4 gm. of calcium peroxid per liter. The action is not instantaneous, but in most cases takes about 2 hours.

The process is hastened (requiring about 15 to 20 minutes) by the addition of a small amount of sodium hydrogen carbonate which rapidly decomposes the peroxid. The hydrogen peroxid as well as the precipitate of calcium carbonate formed by the decomposition of the calcium peroxid may be removed by filtering through manganese dioxid. The hardness of the water is generally reduced by this treatment.

SOILS—FERTILIZERS.

Studies on the properties of an unproductive soil, B. E. Livingston, J. C. Britton, and F. R. Reid (*U. S. Dept. Agr., Bur. Soils Bul. 28, pp. 39*).—The soil used in these experiments is described as "a brownish-yellow coarse sandy loam, 3 ft. or more in depth, resting upon material similar to the Susquehanna clay. Samples taken at intervals from the surface downward show a gradually increasing proportion of silt and clay."

The mechanical analysis shows that "the soil is rather peculiar in that it possesses relatively large amounts of coarse and of fine material, but only small quantities of medium-sized particles." Chemical analysis (by digestion in hydrochloric acid, sp. gr. 1.115) showed potash 0.135, lime 0.145, and phosphoric acid 0.11 per cent. The water extract of the soil contained calcium 11.7 parts per million of air-dry soil, potassium 22.7 parts, phosphate (PO_4) 7.6 parts, and nitrate (NO_3) 5.5 parts. The soil contained 3 per cent of organic matter and 0.1 per cent of nitrogen. Native and cultivated plants growing on the soil exhibited peculiar structures similar to those observed in case of a soil subject to drought.

A series of experiments was made with this soil in small wire baskets described in previous publications of the Bureau (E. S. R., 17, p. 227). In these experiments the influence of the water supply and of different manurial substances was studied. The results show that wheat seedlings were much stunted even when the water content was kept at the optimum (14–17 per cent) throughout the period of growth, indicating that the unproductive character of the soil is not due to lack of water.

It was shown that the soil was "improved to a great extent by the addition of fermented stable manure, green manure (consisting of the stems and leaves of cowpeas), sumac and oak leaves, tannic acid, pyrogallol, calcium carbonate, and ferric hydrate. . . . With the exception of nitrate of soda, ordinary fertilizers have no beneficial effect. When wheat seedlings are grown in aqueous extracts of this soil they make the same kind of growth as in the soil itself. The stunting power of the extract can be corrected by the addition of extract of stable manure, pyrogallol, calcium carbonate, ferric hydrate, and carbon black."

The authors conclude that these facts show that the soil "contains a water-soluble nonvolatile substance or substances, probably organic in their nature, which are toxic to wheat plants, causing a stunting of their growth. The toxicity of the soil is corrected by the use of stable manure, green manure, leaves of sumac, oak, etc., tannic acid, pyrogallol, calcium carbonate, ferric hydrate, and carbon black."

A method for the mechanical analysis of soils, T. Crook (*Econ. Proc. Roy. Dublin Soc., 1 (1904), No. 5, XIII, pp. 267–280, figs. 2*).—In the method here proposed the separations are performed by means of a modification of the Schöne apparatus, the essential features of which are (1) a constant-level water reservoir which can be adjusted to any desired height; (2) an elutriator which differs from the Schöne apparatus in being conical both above and below the cylindrical portion;

and (3) an outlet which can be fitted with delivery tubes of any desired diameter. The methods of standardizing this apparatus are described, as well as the different steps in a mechanical analysis.

The author emphasizes the importance of taking account of coarser constituents of the soil in order that the mechanical analysis may serve as a guide to the structure and physical properties of a soil as it exists in nature. With this object in view he begins with a few kilograms of soil from a typical position and picks out all stones larger than 5 cm. in diameter. One kg. of the soil from which these larger stones have been removed is passed through a sieve with meshes 1 cm. in diameter. The stones collected on the sieve are washed, dried at about 90°, and weighed. Five hundred gm. of the material passing this sieve is put through a sieve with circular holes 1 mm. in diameter. The material remaining on the sieve is washed, dried, and weighed. Twenty gm. of the material passing the sieve, dried at 90° C., is boiled in a porcelain dish for 1 hour with constant stirring and gentle pestling with a rubber-tipped class rod, and is used for elutriation in the apparatus described.

Mechanical analyses of soils and subsoils by centrifugal action; with notes on treatment of samples, J. R. KILROE (*Econ. Proc. Roy. Dublin Soc., 1 (1904), No. 5, X, pp. 223–230, figs. 2*).—The method proposed is a combination of those of Whitney and Bennigsen, and is thus described:

"Adopting the idea of an inverted flask, attach a tube firmly to it, so as to make this serve as a prolongation of the neck. Into the flask thus fitted, earth is introduced, and distilled water poured in, so as almost entirely to fill the neck with clear liquid. The tube is then corked (with india-rubber stopper), a sheath of tin is slipped down over the neck and secured by pliable copper wires to a leather base or cradle, which fits closely to the bottom of the bulb, and bears the extreme statical pressure resulting from the rotary motion. The flasks are then fixed securely on the centrifugal table . . . . with the bulbs inward and the tubes outward, the extremities being about 15 in. from the axis of rotation.

"When the table is revolved for a short time, at 900 revolutions per minute, the coarser particles become precipitated, and so consolidated that, at the close of the operation, when the flask is removed from the table and held with the bulbs downward, the sand and coarse silt remain in the tube, and the clay and fine silt, forming the fluid mixture, are found in the flask. The chief advantage of the apparatus is that the detachable tube admits of the easy removal of the sand and silt. . . .

"The detailed procedure, as practiced in the examination of soils and subsoils at the Geological Survey office, is as follows: In the case of fine homogeneous earths, a quantity of soil or subsoil, dried and averaged, is taken, and passed through a 2 mm. sieve; of this 20 gm., if a sandy soil, 25 if a loam, and 30 if a clay, are taken for treatment. It is boiled with distilled water for some hours, to loosen the clay from the sands and silts.

"The mixture is then thoroughly shaken to break up the compound particles and detach the clay from the sand particles. It is then transferred to the flask, and the latter nearly filled with distilled water to within an inch of the outer end of the connected tube. If this be carefully done, the neck is filled with clear water. The sheath is run down over the tube and neck of the flask, and fastened to the base of the flask. The bulb is then shaken to detach all particles from the bottom, and the whole inverted. The coarser sand and silt fall down through the clear liquid in the tube, and are thus free from clay particles."

Soil moisture investigations for the season of 1904, J. D. TINSLEY and J. J. VERNON (*New Mexico Sta. Bul. 54, pp. 27, figs. 4*).—This is a continuation of experiments of previous years (E. S. R., 15, p. 1060). As in the previous year the crop grown was wheat.

The results in 1903 having indicated that the application of water while wheat was heading and filling was more beneficial than its application before this time, the

experiments in 1904 were designed especially to further investigate this point. Different series of plats were irrigated after the wheat began to head, once a week, once in 2 weeks, and once in 3 weeks. A record of the amounts of water applied; meteorological conditions of the season; the relations between the amount of water applied, soil moisture, and yield; and the movement of the water in the soil is given. Owing to unfavorable meteorological conditions the yield of wheat was only about one-third of that of the previous season.

It was found that irrigating oftener than once in 3 weeks after the wheat began to head increased the yield, but scarcely enough to pay for the additional irrigations. "Twenty-four in. of water gave the greatest yield per inch of water applied, and while 35 and 29 in. of water gave greater yields than did 24 in., the increase per inch of water is very small. Twenty-four in. was the most economical amount." The conclusion is reached that 25 per cent is the optimum amount of water in this soil for the production of wheat and beyond this the wheat is very sensitive to an increase in the moisture content of the soil.

While variations in texture and the irregular distribution of the water through the soil made it difficult to obtain results accurately expressing the true moisture conditions of the soil, the indications are that "the plats as a rule did not gain materially in moisture below the second foot during the season and there were indications of a general loss in total moisture toward the end of the season. There was no indication of an appreciable loss of moisture from the percolation into the soil below the limits of the roots of the wheat."

Soil temperatures 1903–4, G. A. CROSTHWAIT (*Idaho Sta. Bul. 49, pp. 3–6*).—Tabular summaries of weekly observations at Moscow on soil temperatures during 2 years at 10 different depths varying from 1 in. to 6 ft.

Diffusion in acid and neutral media, particularly in humus soils, H. MINSSEN (*Landw. Vers. Stat., 62 (1905), No. 6, pp. 445–476*).—The literature of the subject is reviewed, especially the investigations of Blanck (E. S. R., 14, p. 848), and investigations by the author on diffusion are reported.

The results lead to the conclusion that Blanck's method is so defective and his results so unreliable that his conclusion that diffusion of water in acid soils is hindered by the presence of humus acids is not warranted. The author concludes that neither humus acids nor any other organic or mineral acids in dilute solutions interfere with the diffusion of water or salt solutions. The "physiological dryness" of moor soils can not, therefore, be ascribed to humus acids.

Experiments in fertilizing chernozem, V. V. WIENER (*Khozyain, 1904, Feb., Sup.; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 1, pp. 48–50*).—The article contains the main results of 5 years' work at the Shatilov Experiment Station (Government of Tula) on the question of fertilizing chernozem.

The results are in the main of local and limited interest. A close direct connection was observed between the action of the fertilizers and the meteorological conditions in the sense that higher effects of the mineral fertilizers were observed in years of abundant yields with favorable meteorological conditions, when, according to a generally accepted opinion, chernozem has no need of fertilizers for the production of large crops. Deep and shallow plowing were equally favorable. The author concludes that the reputation of chernozem for great fertility is unmerited and that the use of fertilizers, especially phosphates, is very profitable.—P. FIREMAN.

Soil bacteriological studies, J. G. LIPMAN (*New Jersey Stas. Rpt. 1904, pp. 237–289, pls. 6*).—The importance of the biological processes in the soil is discussed, and studies of the physiology and morphology of members of the Azotobacter group, including three members—*Azotobacter vinelandii*, *A. beyerincki*, and *A. woodstownii*—discovered by the author, are reported.

The relative nitrogen-fixing power of these organisms, as well as of *A. chroococcum* and several smaller bacilli, designated *Bacillus 30a*, *B. 33*, *B. 34*, and *B. 35*, which

accompanied Azotobacter in crude mannite cultures, was studied alone and in association with one another or other organisms, in nutrient media of different kinds (mannite and sodium malate solutions) and in soils.

The analytical results in case of pure cultures show that in the case of *A. vinelandii* the fixation of nitrogen was at the rate of 4 to 5 mg. of nitrogen for every gram of mannite consumed, while in the *A. beyerincki* and *A. chroococcum* cultures the rate of fixation was less than 1 mg. of nitrogen per gram of mannite consumed.

"In the combinations, it appears that *Proteus vulgaris* did not appreciably affect the fixation by *A. vinelandii*, but that *B. new jersey* and *B. pyocyaneus*, both denitrifying bacteria, depressed it considerably, particularly in the case of the former. Of the accompanying small bacilli, *B. 30a* increased the fixation somewhat, *B. 33* depressed it, *B. 34* did not affect it, and *B. 35*, or *B. 35* and *B. 30a* together, increased it. On the other hand, where *B. 30a*, *B. 33*, *B. 34*, and *B. 35* were all inoculated together with *A. vinelandii*, there was no fixation at all by the latter."

A. beyerincki showed uniformly a slighter nitrogen-fixing power than *A. vinelandii*. The decay bacteria depressed the fixation of nitrogen. The decrease was least in the case of *Proteus vulgaris*. Where *B. 30a* was inoculated together with *A. beyerincki*, the fixation was greatly enhanced, the yield being 9.5 mg. as compared with the higher yield of the two inoculations with *A. beyerincki* alone. Where *A. beyerincki* was inoculated together with *B. 33*, the depression was greater than in any other combination.

"The nitrogen-fixing power of *A. chroococcum* in pure culture was practically the same as that of *A. beyerincki*. In the presence of other organisms, however, the former showed somewhat different relations. There was an increased fixation here in the presence of decay bacteria, as well as in the presence of *B. 30a*, *B. 33*, *B. 34*, and *B. 35*. In the presence of *Proteus vulgaris*, the yield of nitrogen was raised from 7.17 mg. to 8.55 mg.; in the presence of *B. new jersey* it was raised to 10.23 mg.; in the presence of *B. 30a*, to 9.16 mg.; in the presence of *B. 33*, to 8.55 mg.; in the presence of *B. 34*, to 9.31 mg.; and in the presence of *B. 35*, to 10.38 mg., the highest yield in the series. . . . There was practically no fixation of nitrogen by *A. woodstownii*, either when growing alone or together with the smaller bacilli. . . .

"The small bacilli did not increase the nitrogen content of the mannite solution to any appreciable extent. When, however, they were inoculated together with *A. vinelandii* they seemingly augmented the nitrogen-fixing power of the latter. . . . The evidence, both microscopical and macroscopical, pointed to the fact that the small bacilli can make more growth in malate solutions than in mannite solutions. The analytical data confirm this evidence."

In view of the results obtained "it is deemed justifiable to state that members of the Azotobacter group are capable of fixing atmospheric nitrogen when growing in pure culture, and that they are affected unfavorably by acid culture media until their growth is entirely stopped, when the acidity reaches a certain limit. Beyerinck's theory, therefore, that the fixation of Azotobacter is symbiotic is proved untenable, and the fact that the development of *A. chroococcum* in nitrogen-poor solutions was made possible by other bacteria indicates, probably, that the latter produced an alkali and decreased the acidity of the culture solution, thus enabling the Azotobacter to develop normally."

Chemical studies of mannite media in which *A. vinelandii* had been grown showed the presence of a small but appreciable amount of nitrogen, in both young and old cultures, not precipitated by lead acetate and a large proportion not precipitated by phosphotungstic acid or tannic acid. Similar studies of Witte's peptone show "that a large proportion of the peptone nitrogen is precipitated neither by the sulphates of the heavy metals nor by tannic acid. The nitrogen carried into the filtrate consists in part of amido-acids, or amido-acid derivatives."

Inoculation experiments are reported which included "one series of investigations on small quantities of soil inoculated with *A. vinelandii*, and kept in the incubator at a uniform temperature; and one series of investigations on cylinder soils inoculated partly with *A. vinelandii* and partly with *A. beyerincki*, and kept under field conditions."

In case of the pot soils there was less loss of nitrogen from the inoculated soils than from the uninoculated. In case of the cylinder soils "there was no decisive gain in the inoculated soils over the uninoculated. There was in all cases a loss of nitrogen during the summer that the soils had been kept bare, and the losses were greatest where manure had been used."

The formation of nitrates in the soil, W. A. WITHERS (*North Carolina Sta. Bul. 190, pp. 8*).—The sources of nitrogen and the conditions favoring nitrification are discussed and laboratory experiments to determine the rate of nitrification of sulphate of ammonia, dried blood, dried fish, tankage, bone, cotton-seed meal, and barnyard manure in different kinds of soils are reported. (See also E. S. R., 16, p. 737.)

"In some soils fish gave the most nitrates at the end of the experiment, in others sulphate of ammonia gave most, in others cotton-seed meal, and in others dried blood. Bone was nitrified least rapidly of the substances used. In some cases, where stable manure was applied in excessive quantities, there was a reduction rather than a gain in the quantity of nitrates, but in other experiments, where the amount was but a little larger than that applied in ordinary farm practice, the formation of nitrates proceeded well and there was no loss by reduction. . . . In some soils very small quantities of nitrates were formed from any of the materials, and in other soils large quantities of nitrates were formed from any of the materials, but each soil showed some material best adapted to it so far as the formation of nitrates was concerned. Some soils used by us nitrified ten times as well as others."

Investigations relative to the use of nitrogenous materials, E. B. VOORHEES (*New Jersey Stas. Rpt. 1904, pp. 191–233, fig. 1*).—This is a report of progress during 1903 in a series of experiments on this subject which has been carried on by the station for a number of years (E. S. R., 16, p. 453).

"The method of treatment has been outlined in previous reports. It includes the study of the availability of nitrogen in various nitrogenous materials, and affords a means for determining their relative value from the economic standpoint. It thus enables the farmer to decide for himself what forms of nitrogen are most desirable under given conditions. The study has also been continued of the composition of cow manure and of the changes in its composition due to leaching. The collection, treatment, and analysis of the manure samples were carried out as heretofore."

The crop grown in 1903 was corn (field and sweet) and marks the beginning of a new rotation.

The relative availability of the nitrogenous materials experimented with in 1903 was as follows:

Relative availability of the nitrogen in different nitrogenous materials.

	Field corn.	Sweet corn.
Sodium nitrate	110.0	100.0
Ammonium sulphate	99.8	83.9
Dried blood	59.2	89.3
Solid manure, fresh	25.7	63.0
Solid manure, leached	39.2	46.5
Solid and liquid manure, fresh	59.2	58.3
Solid and liquid manure, leached	43.2	48.5

Brief accounts of experiments with asparagus and in improving light lands on farms in the State are appended.

On the decomposition of lime nitrogen, F. Löhnis (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *14* (*1905*), *Nos. 3–4*, *pp. 87–101; 12–13*, *pp. 389–400; abs. in Chem. Centbl.*, *1905*, *I*, *No. 26*, *pp. 1731*, *1732*).—A study of the action of bacteria in decomposing calcium cyanamid is reported which showed that in a medium of grape sugar inoculated with soil bacteria the nitrogen of the cyanamid was transformed to ammonia by bacterial action in the same manner as that of urea but at a slower rate.

A number of the organisms active in this transformation were isolated and studied, including *Bacterium putidum*, *Bacillus mycoides*, *Bacterium vulgare* var. *zopfii*, *B. lipsiense* n. sp., *B. kirchneri* n. sp., *Bacillus megatherium*, *Bacterium fluorescens*, *Bacillus subtilis*, *Bacillus ellenbachensis*, and *Bacillus vulgare*. The most active of these were *Bacterium kirchneri*, *B. lipsiense*, *B. vulgare* var. *zopfii*, and *Bacillus megatherium*. Of these only *B. kirchneri* has the power of producing ammonia from urea. Studies of the behavior of these organisms under varying conditions of aeration, temperature, and concentration of nutritive media are also reported.

It was observed among other things that the organisms which were comparatively active in decomposing the lime nitrogen set free only small amounts of ammonia from peptone and that aeration had no essential effect on their activity.

Urobacillus leubei and *Planosarcina pasteuri* also liberated ammonia from calcium cyanamid, but *Urobacillus pasteuri* had little effect.

Utilization of peat in the manufacture of ammonium sulphate, A. Doudlet (*Ann. Gembloux*, *15* (*1905*), *No. 8*, *pp. 437–440*).—This article refers to the various methods which have been proposed for the manufacture of ammonium sulphate, and describes and recommends that of Woltereck, which consists of treating the partially dried peat with a current of hot air and steam, maintaining the temperature at 450° C., the treatment resulting in the formation of ammonia, acetic acid, etc. The adaptability of the process to countries like Belgium, where the supply of peat is abundant, is pointed out.

On the loss of substances useful as plant food sustained in moss manure, T. Macfarlane (*Proc. and Trans. Roy. Soc. Canada*, *2. ser.*, *10* (*1904*), *Sec. III*, *pp. 61–69*, *pls. 2*).—Observations on the amount and value of the manure obtained in dry moss closets by methods previously described (E. S. R., 16, p. 349) are reported.

In one experiment the product for 3 persons during 6 months, using 20 lbs. of moss litter, weighed 70 lbs. The material contained 62.6 per cent of water, and the dry matter 4.88 per cent of nitrogen, 4.79 per cent of phosphoric acid, and 3.12 per cent of potash. On this basis the total annual product per person would be worth 18 cts.

In another experiment extending over 3 months and using 15 lbs. of litter, the total product weighed 60 lbs. and contained 67.5 per cent of water. The dry matter contained 3.33 per cent of nitrogen, 3.52 per cent of phosphoric acid, and 1.05 per cent of potash. The value of product per person annually was 17.4 cts.

In an experiment extending over 3 weeks, in which 410 gm. of the moss manure obtained in the previous experiments was kept moistened with urine, the amount of nitrogen so added being 18.09 gm., the loss of nitrogen was 15.48 gm. The addition of a mixture of bone superphosphate and double manure salt, magnesium sulphate, and gypsum reduced the losses to some extent, but the results indicate "that urea in decomposing under the above-described circumstances is not all resolved into carbonic acid and ammonia, but that a varying quantity of nitrogen escapes in the free state."

Concerning the agricultural value of sodium salts, H. J. Wheeler and G. E. Adams (*Rhode Island Sta. Bul. 106*, *pp. 111–153*, *dgms. 11*).—This is essentially an account of a continuation on the same plats during 1900 and 1901 of experiments of previous years (E. S. R., 17, p. 232), attention being directed especially to a study of the extent to which the liberation of plant food other than potash in soil might explain the beneficial effects of sodium salts which had been observed in many cases

even when the sodium salts were used in connection with full rations of potash. The after effects of the sodium and potassium salts up to 1904 have also been studied.

These experiments, begun in 1894, have been made on 48 twentieth-acre plats grouped in 4 series of 12 each. "Two of the series received sodium chlorid (common salt) and potassium chlorid (as commercial muriate of potash). The other two received potassium carbonate and sodium carbonate. One of the chlorid series and one of the carbonate series was limed in 1894, and the other series in each case remained unlimed until 1902, when an application of slaked lime was made to all of the 48 plats. . . .

"Four of the 12 plats [of each series] received full rations of the potassium salt; to one of these a quarter, to another a half, and to another a three-quarter ration of sodium salt was added. Four other plats received full rations of sodium salt; to one a quarter, to another a half, and to a third a three-quarter ration of potassium salt was added. One of the 4 remaining plats received a quarter ration of each salt, one a half ration of each, one a three-quarter ration of each, and the fourth a full ration of each. The plats in all of the series were manured alike with magnesia, phosphoric acid, and nitrogen.

"In the year 1900 Indian corn was planted upon the entire area of all of the plats, and in 1901 one or two rows of a number of different varieties of plants were grown, in order, if possible, to obtain further indications as to what varieties seemed most likely to be helped by sodium salts."

The latter included radishes, chicory, carrots, mangel-wurzels, squash, and soy beans.

"The results with Indian corn in 1900 show, so far as concerns the yields of ears, that it was doubtful if sodium chlorid (common salt) aided in raising the yield even when the amount of muriate of potash was reduced to 70 lbs. per acre. The same failure of sodium carbonate to prove of positive benefit was observed in connection with potassium carbonate when the amount of the latter substance was reduced so as to contain the same amount of potassium as 70 lbs. of the muriate of potash. Concerning the yields of stover, there were somewhat greater indications of benefit from the use of the sodium salts than in the case of the ears, yet the apparent advantage from their use was very slight."

In case of radishes, chicory, carrots, and mangel-wurzels, sodium salts were apparently beneficial when the amounts of potash salts used were small. In case of soy beans and squash sodium salts were of little or no benefit even in presence of small amounts of potash.

"In 1902, 1903, and 1904 no further applications of sodium or potassium salts were made, but each plat continued to receive annual applications of phosphoric acid and nitrogen. Where the large applications of potassium salts had been made previously, it was found that timothy and clover were much better able to persist than elsewhere. The influence of the previous applications of potassium salts still continued in a most striking manner even the third year, in all cases where large amounts were used at that time, as was fully demonstrated by the much greater yields of hay.

"Considerable evidence was afforded that the earlier applications of sodium salts were now helpful by way of increasing the crops of hay in those cases where the previous applications of potassium salts had been large." It is suggested that this may have been due to conservation of potash by soda in the soil.

Analyses of commercial fertilizers, M. A. SCOVELL, H. E. CURTIS, and W. H. SCHERFFIUS (*Kentucky Sta. Bul. 117, pp. 87–171*).—The results of analyses during 1904 of 630 samples of fertilizers are reported. Of these "111, representing 89 brands and 33 firms, fell so far below the guaranteed analyses in phosphoric acid, nitrogen, or potash, or any two or all three of these ingredients, that the deficiencies could not be accounted for by variations in sampling or analysis."

Attention is called to the advisability from the standpoint of economy of purchasing only high-grade fertilizers, and it is stated that "it is an utter waste of money to purchase potash or ammonia in fertilizers containing less than 1 per cent of these ingredients."

Analyses of commercial fertilizers and Paris green, W. C. STUBBS and C. H. O'ROURKE (*Louisiana Stas. Bul. 80, 2. ser., pp. 104*).—This bulletin is a detailed report on the fertilizer and Paris green inspection in Louisiana during the season 1903–4. It includes also the text of the State fertilizer law and the law of 1904 relating to Paris green. General notes on the nature, purchase, and valuation of fertilizers are included.

Inspection and analyses of commercial fertilizers on sale in the State, W. F. HAND ET AL. (*Mississippi Sta. Bul. 85, pp. 31*).—Analyses and valuations of 280 samples of fertilizers examined during the season of 1903–4 are reported, with brief notes on the general results of inspection and on valuation, and the text of the State fertilizer law as amended in 1904 to provide for the branding of fertilizers with reference to their grade.

Analyses and valuations of fertilizers, J. P. STREET, W. P. ALLEN, and V. J. CARBERRY (*New Jersey Stas. Rpt. 1904, pp. 43–98*).—This is a reprint of matter contained in Bulletins 176 and 177 of the station (E. S. R., 16, pp. 556, 761), with the addition of a list of manufacturers whose goods were sampled and analyzed during 1904, and data relating to the wholesale prices of fertilizing materials in New York during different months of the year 1903 and valuations for 1904.

AGRICULTURAL BOTANY.

Physiological investigations on young shoots of the grape, E. GRIFFON (*Rev. Vit., 24 (1905), No. 607, pp. 117–122*).—On account of the common practice of topping vines to promote fruitfulness, the author investigated the physiology of the subject.

It has been held by many that the presence of starch in the young growth is an indication that these shoots are living a sort of parasitic life at the expense of the remainder of the plant. The author studied the photosynthesis of the plant in relation to the age of different parts, the principal investigations being made with grapes, although a number of other economic plants were included in his studies. He claims that the presence of starch in a young rapidly growing shoot is not an indication of the ability on the part of the shoot to fix carbon dioxid, nor can it be considered as a measure of the energy of photosynthesis.

The absence of starch, on the other hand, does not indicate that a part of a plant is incapable of carbon dioxid assimilation. The suppression of the extremities of the vine is not correctly based on the ground of their being parasites, as there was found little evidence of such a habit of growth. The young leaves were found capable of assimilating carbon dioxid immediately after their expansion. The true explanation of the beneficial action of topping is that this process establishes a beneficial equilibrium between the remaining foliage and the forming fruit.

Recent investigations on the rôle of hydrocyanic acid in green plants, M. TREUB (*Ann. Jard. Bot. Buitenzorg, 2. ser., 4 (1904), pt. 2, pp. 86–147, pls. 9*).—Investigations by the author and others have shown the frequent occurrence of hydrocyanic acid in various tropical plants, its formation seeming to be dependent upon the simultaneous presence in parts of the plant of carbohydrates and inorganic compounds of nitrogen, probably in the form of nitrates.

When these conditions are present hydrocyanic acid is formed and the theory has been evolved that hydrocyanic acid is the first recognizable nitrogen compound in the plant, if not the first nitrogen compound actually formed by the plant. Among the plants reported as containing hydrocyanic acid was *Phaseolus lunatus* (E. S. R.,

11, p. 121). On account of the importance of this plant and the fact that it is, through its root tubercles, an active assimilator of nitrogen, studies were begun with it in 1897 and continued with various interruptions for several years.

The experiments, which are described in detail, show that sugar, most probably in the form of glucose, is indispensable to the formation of hydrocyanic acid in the leaves of *P. lunatus*, and evidence is produced showing that nitrates exert a direct influence on the production of hydrocyanic acid. The author, summarizing his work, again declares that hydrocyanic acid is the first recognizable product of the assimilation of nitrogen in the leaves of *P. lunatus*.

The assimilation of leucin and tyrosin by plants, L. LUTZ (*Bul. Soc. Bot. France, 52 (1905), No. 2, pp. 95–101, fig. 1*).—In a previous publication (E. S. R., 11, p. 316) the author stated that phanerogams could not assimilate leucin or tyrosin as their only sources of nitrogen. The frequent occurrence of these substances in seeds and the experiments of others have led to a repetition of the author's studies along this line.

Experiments are reported with cucurbit seedlings and a number of molds in solutions containing leucin and tyrosin as the only sources of nitrogen. Where leucin was added to the culture medium, gains of 35.8 to 40.8 per cent in nitrogen are reported for the cucurbits, while for tyrosin a gain of 11.9 per cent is given. Spores of Aspergillus and Penicillium sown in culture media made excellent growth, showing that both phanerogams and fungi can use these organic compounds as sources of nitrogen. For the fungi they are about equally efficient, but for the flowering plants leucin, being more soluble, is much better assimilated than tyrosin.

The assimilation of organic nitrogenous substances by plants, L. LUTZ (*Bul. Soc. Bot. France, 52 (1905), No. 4, pp. 194–202*).—A summary is given of the investigations of the author and others on the assimilation of organic nitrogenous compounds by plants, many of the more important papers having been noted elsewhere (E. S. R., 8, p. 843; 10, pp. 235, 414; 11, p. 316; 14, pp. 119, 422).

In all the author's experiments the flowering plants were grown in sand or similar cultures, the seed being first sterilized. The algæ were grown in Molisch's culture medium and the fungi in Raulin's liquid. For each kind of plant the only source of nitrogen was to be found in the compound under investigation.

Flowering plants, algæ, and fungi can take the nitrogen necessary for their growth from salts containing amin compounds. This appears to take place without transformation into nitric or ammoniacal nitrogen. Methylamin is an excellent source of nitrogen, but benzylamin is not, and phenylamin is poisonous. The algæ seem somewhat less subject to injury by phenylamin than flowering plants. Ammonia compounds, pyridin bases, and alkaloids are not directly assimilable, but they may become available in the presence of some form of assimilable nitrogen. The same rule applies for the alkaloids as for the amins, the less complex the molecule the more assimilable they are.

The instability of amid compounds limited their use to algæ and fungi. As with the amins, the amids of the fatty series are directly assimilable by plants, but those of the aromatic series are not adapted to plant growth. The investigations showed that asparagin and urea caused better growth than the form of nitrogen existing in Raulin's fluid. Leucin and tyrosin under conditions described above are assimilable by each class of plants studied. The nitriles are only slightly assimilable when used alone, but when used in connection with other forms of nitrogen are taken up to some extent by the plants.

Compounds of the aromatic series are either not assimilable at all or are poisonous to plants. Comparing the assimilability of the amin, amid, and nitrile compounds, it is stated that for compounds of equal molecular complexity the amins are the most assimilable, followed by the amids and nitriles. Hydroxalamin acted as slightly toxic to all plants tested.

The author believes it is practically demonstrated that many organic nitrogenous substances are directly assimilated by plants, and the common belief that ammoniacal fermentation takes place first, followed by nitric fermentation, is not in accord with what actually occurs in the plant.

The comparative assimilability by plants of ammoniacal salts, amins, amids, and nitriles, L. LUTZ (*Bul. Soc. Bot. France, 52 (1905), No. 3, pp. 159-162*).—Studies on the assimilability of these compounds as sources of nitrogen for Aspergillus and Penicillium are reported, comparisons being made with ammonium nitrate.

The fungi were sown in modified Raulin's solution, and in the same solution with various amins, amids, and nitriles substituted for the ammonium nitrate. The assimilability of the amins was in inverse proportion to the size of the molecule, while the amids were nearly the complement of the amins and the nitriles were only slightly assimilated. The comparative studies with ammonium salts show that of all nitrogenous bodies the amids are the most assimilable. In general, nitrogenous compounds are assimilable in proportion to the complexity of their molecule.

FIELD CROPS.

Annual report of the Alaska Agricultural Experiment Stations for 1904, C. C. GEORGESON (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 265-360, pls. 7*).—The work for the year is summarized, and a report on the grazing lands of the South Alaska coast, by C. V. Piper of this Department, included.

The grazing lands of the Yakutat Plains, the Kenai Peninsula, Kadiak Island, and Alaska Peninsula and adjacent islands are described, and their utilization is pointed out. The principal native grasses and forage plants are noted with reference to their occurrence and the soils and localities they occupy. The 3 most common forage plants of the entire region are bluetop (*Calamagrostis langsdorfii*), sedge (*Carex cryptocarpa*), and beach rye (*Elymus mollis*). The following analyses of these 3 plants were made by the Bureau of Chemistry of this Department:

Composition of Alaska forage plants.

	Moisture.	Ash.	Ether extract.	Crude fiber.	Proteids.	Nitrogen-free extract.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Bluetop	7.18	3.90	1.03	42.94	4.58	40.37
Sedge	5.85	10.65	2.12	25.72	10.32	45.34
Beach rye	11.92	7.51	2.26	30.31	12.71	35.29

The experience in keeping sheep, Angora goats, beef cattle, and dairy cows in different sections of this region are briefly reviewed. In the author's opinion the outlook for sheep raising is doubtful, but the keeping of goats and cattle seems promising. Notes on numerous grasses and other forage plants on the Alaska coast are given.

Work at Sitka Station.—The following composition of a dried sample of beach grass silage from the station's silo at Sitka was determined by the Bureau of Chemistry of this Department: Fat 3.32 per cent, protein 10.64, ash 6.89, crude fiber 34.64, and nitrogen-free extract 44.51 per cent. The ash sample contained 69.77 per cent of water. Analyses of 16 samples of soil from the Copper Center Station and of 1 sample from near the mouth of the Stikine River, made by the Bureau of Soils of this Department, are also reported.

The present condition and amount of growth of apples, cherries, plums, bush fruits, and ornamentals are briefly noted, as are also the results with vegetables and grasses. Tall meadow oat grass has so far been the most successful of the grasses

tried. Fertilizer experiments showed that a much better growth was made where a heavy dressing of caustic lime was applied. This was especially apparent on raw peaty soil seeded to common oats. Where a ton of caustic lime was applied per acre, together with 300 lbs. of muriate of potash, a uniform and fair growth of oats was obtained, while on the plats receiving the muriate of potash alone the plants turned yellow and died.

Work at Kenai Station.—The progress of work at Kenai is reviewed and notes on the results with the different crops are given. The use of 300 lbs. of superphosphate per acre in connection with growing cereals gave a much more even, uniform, and rank growth and a heavier yield than the same crops on unfertilized soil. A plat of common oats protected on all sides by timber stood from 40 to 48 in. high, while a similar plat fully exposed to the inlet winds reached a height of only 30 in. Of several winter grains tested winter wheat and Excelsior rye survived the cold season.

The milk produced by each cow of the station herd is recorded. The best cow produced a total yield of 5,437.5 lbs. in a milking period of 268 days.

Work at Copper Center Station.—At Copper Center numerous varieties of barley, oats, wheat, vegetables, and grasses were grown. Sixty-day and Finnish Black oats matured in part, but the wheats did not ripen. Barley, which generally ripens, also failed to mature this season, but the several varieties gave a good crop of hay. Manchuria, Lapland, and Mansury barley came nearest to ripening. The yields of different kinds of grain cut for hay ranged on unfertilized land from 763 to 1,907 lbs. per acre, and on fertilized land from 2,343 to 5,085 lbs. Of the grasses, timothy matured seed, while the seed of redtop, blue grass, and meadow foxtail was about matured August 15. The results of fertilizer tests again showed that newly cleared land is less productive than land which has been under culture.

Work at Rampart Station.—Barley and oats matured this season at this station, while at Copper Center, in a latitude of 3° 30′ farther south, the same varieties were killed. The general progress in the establishment of the station is described.

Cooperative experiments on Wood Island.—Five varieties of barley sown April 18 gave promise of ripening, while 3 varieties of oats made a good growth but did not mature. Timothy grew 3½ feet high and produced long full heads. A few reports of the results of the seed distribution in cooperation with the Bureau of Plant Industry of this Department are reproduced.

Daily records of soil temperatures at Sitka, Kenai, and Copper Center and meteorological records from several stations are given in tables.

Annual report of the Hawaii Agricultural Experiment Station for 1904, J. G. Smith (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 361–382, pls. 2*).—A general review of the activities of the station during the year is given and the results of investigations are reported.

An experimental crop of tobacco grown in 1904 produced about 1,000 lbs. of cured leaf, exceedingly variable in quality. Deli, Florida Sumatra, Java Sumatra, Connecticut Broad Leaf, Vuelta Abajo, Connecticut Havana, Florida Havana, and Spanish Zimmer were grown. The quality of the Cuban type was uniformly much better than that of the Sumatra. The crop was grown on new land in an untried locality, and numerous delays interfered with the work. The results indicate that the tobacco of this region colors well, tends to run to the dark shades, is likely to be mild in flavor, and has a good burn. More definite results are expected from the second season's work.

Chemical work for the station is outlined by the chemist, and a partial list of the injurious insects of Hawaii is presented by the entomologist. The horticulturist gives notes on the culture of the banana, mango, cacao, and avocado pear, and also on the black rot of cabbage. Successful experiments in budding the mango have shown that it is perfectly practicable to propagate it by this method in the islands.

Experimental shipments of avocado pears to Manila and to New York have shown that these fruits can be successfully shipped to these points.

Annual report of the Porto Rico Agricultural Experiment Station for 1904, D. W. MAY (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 383–424, pls. 5*).—A general review of the station work is given and the agricultural possibilities of the island are discussed.

Report of the entomologist and botanist, O. W. Barrett (pp. 387–406).—The plant collections, comprising variety tests with bananas, yautias, cassava, orchard fruits, forest trees, fiber plants, and miscellaneous crops are briefly described, and the new additions noted.

Tests of commercial fertilizers, coffee pulp, stable manure, and guano in yautia culture resulted in the highest yield from the use of about 30 tons of stable manure per acre, giving edible tubers at the rate of about 16 tons per acre, as compared with 8 tons on one of the check plats. The highest yield per plant, 3.22 lbs., was obtained in the plat receiving stable manure, and the lowest yield per plant, 1.6 lbs., in the check plats. A second crop of tubers was obtained from the same plants left standing after the first ripe roots had been removed.

Four varieties of cassava analyzed by the Bureau of Chemistry of this Department, showed a variation in starch content of from 21.50 to 31.69 per cent. Ceiba, the variety showing the highest percentage of starch, is one of the 3 best native sorts. The native "malanga" (*Colocasia antiquorum esculentum*) made a very promising growth, and the mature roots, according to an analysis made by the Bureau of Chemistry of this Department, contained 14.94 per cent of starch and 74.47 per cent of moisture. A yield of about 15 tons per acre of edible canna roots was obtained. These roots showed a starch content of 19.41 per cent, with 70.25 per cent of water. The prevalence and effects of certain insect enemies and fungus diseases are described.

The outlook for the culture of citrus fruits, pineapples, mangoes, and aguacates is summarized by the assistant horticulturist, H. C. Henricksen.

The station was successful in growing seedling *Castilloa elastica* from seed, and the behavior of some of the distributed trees indicates that Castilloa should be planted only in rich moist soil.

Report of the coffee specialist, J. W. van Leenhoff (pp. 406–410).—The average yields of an old coffee grove in 1903 were observed to be as follows: Ripe berries 887 lbs. per acre, coffee ready for market 180¼ lbs., productive trees per acre 746, and the product per tree 0.261 lb. The cost per 100 lbs. for harvesting and marketing the coffee was $2.26. Notes are given on a number of experiments begun in cutting coffee trees to stumps, renovating old coffee plantations, and establishing new plantings.

Bananas, yautias and economic fruits such as oranges, lemons, and figs, as well as rubber and eucalyptus trees, cotton, and varieties of yams and sweet potatoes, have been distributed in the coffee regions for soils not occupied by coffee.

Report of the tobacco expert, J. van Leenhoff (pp. 410–425, pl. 1).—This report is an abstract of Bulletin 5 of the station, which has already been noted (E. S. R., 17, p. 32).

Cooperative experiments in agriculture, C. A. ZAVITZ (*Ann. Rpt. Ontario Agr. and Expt. Union, 26 (1904), pp. 13–31*).—The organization of the Experimental Union is described, and the results obtained during 1904 are summarized and briefly noted.

Experiments were conducted during the season by 4,050 farmers, and the work carried out was along 35 distinct branches of field agriculture. The leading varieties of grain crops gave the following average yields per acre: Tartar King oats, 120 tests, 50.82 bu.; Mandscheuri Six-rowed barley, 33 tests, 36.23 bu.; Guy Mayle Hulless barley, 31 tests, 29.43 bu.; Wild Goose spring wheat, 19 tests, 19.48 bu.; Common

emmer, 7 tests, 56.85 bu.; Red spelt as compared with emmer, 31.58 bu.; New Canadian Beauty field peas, 22 tests, 30.03 bu.; Silver Hull buckwheat, 4 tests, 23.38 bu.; Marrowfat field beans, 10 tests, 30.33 bu.; Imperial Amber winter wheat, 3 tests, 22.47 bu.; and King Philip corn, 9 tests, 55.99 bu.

The leading varieties of field roots and fodder crops gave the following yields per acre: Yellow Leviathan mangels, 5 tests, 29.31 tons; New Danish Improved sugar beets, 9 tests, 31.29 tons; Magnum Bonum Swede turnips, 4 tests, 22.17 tons; Redtop White Globe turnips, 1 test, 33.48 tons; Mammoth Intermediate Smoot White carrots, 2 tests, 16.16 tons; Henderson Eureka fodder corn, 2 tests, 21.22 tons; Early Amber sugar cane sorghum, 1 test, 18 tons; grass peas in comparison with vetches, 4 tests, 5.90 tons; and Dwarf Essex rape, 1 test, 25.72 tons. Dwarf Bonanza rape gave a yield almost as large as Dwarf Essex.

The leading varieties of hay crops were Japanese Barnyard millet, Mammoth red clover, lucern as compared with sainfoin and Burnet, and tall oat grass tested with several other common grasses. The results with sowing hairy vetches, winter rye, and crimson clover in the fall show that hairy vetches gave a yield of 6.8 tons and winter rye of 4.3 tons of green crop per acre during the last 2 seasons, while crimson clover was badly winterkilled in each of the 2 years.

The average yields of Empire State and American Wonder potatoes, 2 late varieties grown in 62 tests, were 224.5 and 221.8 bu. per acre, respectively. Of medium early varieties Rose of the North stood first, with an average yield of 200.4 bu. per acre in 55 tests, while among the early varieties, Early Andes in 163 tests ranked first with 170.8 bu. Hilling potatoes gave better results than level cultivation, which is considered due to a cool, damp season. The results of 17 tests show that seed potatoes coated with land plaster yielded 228.2 bu., as compared with 213.2 bu. per acre for untreated seed.

In 1904 experiments with fertilizers were confined to swedes, and the yields obtained per acre for the different methods of treatment were as follows: Check plat 24 tons; 160 lbs. of nitrate of soda per acre, 26.1 tons; 160 lbs. of muriate of potash, 26.7 tons; 320 lbs. of superphosphate, 28.1 tons; 213 lbs. of complete fertilizer, 29.3 tons; and 40,000 lbs. of cow manure, 32.5 tons.

In 8 tests with sweet corn Mammoth White Cory ranked first in yield, quality, and earliness. This variety required only 71 days to produce ears ready for table use. Field corn planted in hills yielded 2.14 tons of ears per acre, while corn in drills yielded 1.58 tons. In total crop the average of 4 tests showed but little difference between the 2 methods of planting.

Report on the manuring of seeds hay, 1904, W. ALLAN (*Edinb. and East of Scot. Col. Agr. Bul. 5, pp. 21*).—Fertilizer experiments in connection with growing different grass mixtures were conducted at 21 centers.

Nitrogen was used at the rates of 20, 30, and 40 lbs. and phosphoric acid and potash at the rate of 40 and 30 lbs., respectively. Nitrogen proved to be the most effective element, the best results being obtained where a mixture of nitrate of soda and sulphate of ammonia was used. When the 2 substances were applied alone, nitrate of soda gave better results than sulphate of ammonia. The largest quantity of nitrogen used gave a larger yield and better financial returns than the smaller quantity.

When applied alone nitrogen gave satisfactory results, but potash and phosphoric acid each given alone were not very effective. The largest yields and the greatest profits in the entire series of tests were obtained from the use of complete applications.

Culture and fertilizer tests on heath soils, B. HARDT (*Deut. Landw. Presse, 32 (1905), No. 29, pp. 253, 254*).—Experiments were conducted for 4 years to determine the effects of lime and marl on new heath soil, and to ascertain the possibility of growing oats under such soil conditions.

The rotation of crops by seasons was as follows: Lupines, oats and serradella, oats and clover, clover, and clover. Both lime and marl at the rate of 2,500 and 5,000 kg. per hectare, respectively, proved very effective and highly profitable. The gross as well as the net returns were in favor of marl, and the use of lime in 2 applications gave better results than applying the entire quantity at one time. The yields of oats obtained were satisfactory. The method successfully employed for the reduction of the heath soil is described.

Soiling crops, 1904, G. A. BILLINGS (*New Jersey Stas. Rpt. 1904, pp. 342–366, pls. 4*).—Summer soiling was carried on this season from May 14 to October 20, 160 days.

A herd equivalent to 43 full-grown animals was supplied with roughage from a continuous rotation of forage crops. The data show that 221.89 tons were grown at a cost of $429.21, or at an average of $1.93 per ton. The feeding and manurial value of the crops is shown, and the data deducted indicate that 46 tons of clover hay furnished 11,316 lbs. of protein, 2,116 lbs. of crude fat, and 64,952 lbs. of carbohydrates; 56 tons of mixed hay, 11,312 lbs. protein, 2,912 lbs. crude fat, and 77,168 lbs. carbohydrates; and 227 tons of corn silage, 7,718 lbs. protein, 3,632 lbs. crude fat, and 77,180 lbs. carbohydrates.

It is further shown that the total tonnage of soiling crops furnishes nitrogen equivalent to 5.15 tons of nitrate of soda, phosphoric acid equivalent to 1.11 tons of acid phosphate, and potash equivalent to 1.89 tons of muriate of potash, and that the manurial value of this crop is also equivalent to 9.9 tons of barnyard manure, 3.16 tons of nitrate of soda, and 0.98 ton of muriate of potash. A comparison of the manurial and feeding value, estimating barnyard manure at $1.50 per ton, nitrate of soda at $45, and muriate of potash at $42, shows that the value of the soiling crops for green manure would be $331.86, or $97.35 less than the feeding value.

The rotation furnished a continuous supply of forage. The average yield per acre for all the crops, including alfalfa but not including mixed grasses, was 11.99 tons per acre. It is pointed out that the protein produced by one acre of alfalfa yielding 17.5 tons of green fodder is equivalent to the quantity of protein in 6.4 tons of clover hay, or about 5 tons of wheat bran. On the average for 6 years alfalfa yielded 19.18 tons per acre, equivalent to 72 tons of clover hay, according to the nutrients contained in the 2 crops.

Of the different crops grown alfalfa was found to be the most economical. Barnyard millet, pearl millet, Thoroughbred White Flint corn, and Southern White corn, being about equal in yield, ranked next to alfalfa in the average production of forage. General notes on the different crops are given. The results of an experiment in seeding alfalfa at different periods were decidedly in favor of seeding between the 1st and the 15th of August.

The inoculation experiments of the season gave results in favor of the cylinder not inoculated. The results are not considered as showing that inoculation has been a failure, but that the cylinders not inoculated obtained the alfalfa bacteria from some source other than the use of a soil solution or soil as applied in this experiment. The application of a soil infusion was much more effective than the use of the soil itself. Different kinds of soil showed a variation of 74 per cent in responding to inoculation, Freehold marl in Monmouth County being the least affected by inoculation, and Woodbine sand in Cape May County making the greatest gains. Nitrate of soda at the rate of 147 lbs. per acre, costing $3.31, gave a loss of 135 per cent in favor of inoculation.

Of 3 varieties of corn compared to ascertain their value for silage Southern White in rows 3 ft. apart and at intervals of 9 in. in the drill gave the most satisfactory results, both in respect to quality and quantity. The yield of this variety was 11.84 tons per acre, while Hickory King produced 7.8 tons, and Thoroughbred White Flint, which was exceptionally good in quality, 8.77 tons.

Top-dressing with nitrate of soda increased the yield of both wheat and rye, though with profit only in the latter case.

Alfalfa in Michigan, C. D. Smith (*Michigan Sta. Bul. 225, pp. 133–148, figs. 3*).—This bulletin reviews the history of experiments with alfalfa at the station and throughout the State, summarizes the results obtained, and from the data secured presents conclusions with reference to the culture of the crop.

At the station alfalfa seemed to give as good results on light sand as on well-drained clay. Although artificial inoculation was not used at the station, the roots of the plants were practically in all cases provided with nodules, but from some parts of the State it was reported that nodules were not present, and it is therefore considered best to inoculate the seed or soil when sowing.

It is recommended that 20 lbs. of seed be used per acre when the germination is above 80 per cent, and larger quantities when it is below 80 per cent. In the southern part of the State sowing in May seems to be preferred, while in the portion permanently covered with snow during the winter sowing in August is thought to be best.

Tests with seed bought in the market, Utah and Colorado grown seed, sand lucern, and Turkestan, showed that Turkestan gave smaller yields than the others but proved hardier. Sand lucern apparently stood the winter as well as Turkestan, and Utah and Colorado grown seed gave results which differed but little. Clipping the crop in October, when the aftergrowth since August 30 was fully knee-high, and leaving the clippings as a mulch was a serious injury to the crop of the following season, and indicated that under the conditions alfalfa should not be mowed later than the last week in August.

Analyses of samples from 3 cuttings show that the composition of the cuttings made June 7 and July 11 differed but little, while the third, made August 30, was lower in ash, higher in total protein, but much reduced in true proteids, to which the hay owes its feeding value.

Of 76 culture tests with alfalfa made by farmers in the State, 32 were absolute failures, 24 were partially successful for a single year, and 16 for 2 or more consecutive years. Winterkilling, June grass, and dodder, are given as the chief enemies of the crop in Michigan.

Legumes other than alfalfa, C. D. Smith (*Michigan Sta. Bul. 227, pp. 165–184*).—Culture tests with a large number of leguminous crops are briefly reported and an analytical key to vetches is given.

The results with lupines, kidney vetch, goat rue, crimson clover, and vetches indicate that these crops are of some value as green manures, especially on sandy soils. Crimson clover, serradella, sainfoin, and Japan clover gave some promise as a food supply for stock. Sweet clover, fenugreek, *Astragalus sinensis*, sulla, peanuts, chick-pea, and lentils are apparently of no value for Michigan.

The tests at the station with *Lathyrus sylvestris* indicate that this crop is of little value, either as a fodder plant or for green manure. Iron, New Era, Whip-poor-will, and Black Eye cowpeas are recommended for plowing under to enrich Michigan soil in nitrogen. These varieties ripen seed only in unusually warm seasons with frosts late in the fall. Of the soy beans tested, Medium Green, Early Black, and Yellow produced abundant forage, and Ogemau, Ito San, and Government 9413 are good types for seed production.

Hairy vetch at the station has not been a success as a forage crop. *Vicia picta*, flowering early in July and fruiting in the middle of August, produced a large yield of seed but only a small amount of green forage, while *V. canadensis*, *V. angustifolia*, and *V. peregrina* yielded abundant foliage and a smaller amount of seed. *V. disperma*, *V. biennis*, *V. gerardii*, and *V. globosa* also produced considerable green forage. *V. faba* is considered totally unsuited to Michigan. It is reported that vetch has become a weed difficult to exterminate on the college farm and elsewhere.

An analytical study of the roots and upper portions of the plants of Medium Green and Ogemau soy beans, New Era cowpeas, *V. globosa*, second crop June clover, and new seeding June clover showed that on the basis of normal yields of forage per acre Medium Green soy beans yielded 152.29 lbs. of nitrogen per acre; the cowpeas, 61.90 lbs.; the vetch, 77.10 lbs.; the second crop clover, 51.47 lbs., and the new seeding clover, 49.06 lbs.

On September 15, 1904, 13,590 lbs. of soy beans were harvested and put into the silo. The silage taken from the silo the last week of April, 1905, had a peculiar and unpleasant odor. When weighed out it amounted to 11,285 lbs., and had the following composition: Water 68.97 per cent, ash 5.69, ether extract 2.97, crude fiber 9.09, protein 3.28, and carbohydrates 10 per cent. It was fed to dairy cows.

"Inasmuch as the soy beans do not grow tall and do not therefore stay bound in the bundle with the corn when cut with the harvester, and inasmuch as repeated experiments at this station show that the vines of the Red Speckled and of the Southern Prolific beans cling to the corn and are harvested with it, it is suggested that one or the other of these legumes be used instead of soy beans for enriching in protein the corn in the silo."

Trials with alfalfa, J. H. Sheppeed (*North Dakota Sta. Bul. 65, pp. 550–556, pls. 2*).—The results of 4 years' trials with alfalfa, and for the most part previously reported in former publications of the station, are reviewed.

The experiments at the station have indicated that alfalfa should be sown without a nurse crop on well prepared land at the rate of 15 lbs. of seed per acre. The common commercial strains of alfalfa seed were found not to be well adapted to the conditions of the region, and this has induced the station to breed hardy strains. In 1904 the yield of hay from the first mowing of Turkestan alfalfa seeded in 1901 was at the rate of 3,600 lbs. per acre, and the second growth, which had been hindered by extremely dry weather, gave 1,000 lbs. of hay per acre. A plat of the same variety seeded in 1902 yielded 4,200 lbs. of hay per acre on June 21, and 1,880 lbs. from the second cutting.

Grimm alfalfa showed a good stand in 1904, but did not grow as high as the Turkestan. The yield of hay from the first cutting was 3,720 lbs. per acre. The second growth, although not quite mature when killed by frost, was harvested for seed. It is believed that the trials indicate that alfalfa may ultimately prove a successful crop in the State.

Experiments in clover growing, J. H. Sheppeed (*North Dakota Sta. Bul. 65, pp. 543–550, pls. 2*).—The clover trials made by the station during 12 years are reviewed.

It was found that seeding clover, or clover and timothy, with a grain drill gives much greater assurance of a stand than broadcasting. With one exception during 9 years, medium red clover seeded with a nurse crop passed through the first winter without killing out. Allowing the second growth to remain as a winter protection gave good results in preventing winterkilling and in reenforcing the stand by means of the new seed.

It was observed that the average stubble field was in most seasons efficient as a winter protection. Inspection after each of 11 winter seasons did not reveal a case of heaving by frost. Where an ice sheet covered the plants, however, the clovers, alfalfa, timothy, and redtop were killed out, while brome grass and the weed quack grass had withstood this adverse condition.

Satisfactory results have been obtained from using 15 lbs. of clover seed per acre, and a mixture of 5 lbs. of red clover seed and 8 lbs. of timothy has given a mixture of from one-half to three-fourths of timothy plants in the resulting stand. Ten lbs. of Mammoth clover with 4 lbs. of timothy seed have given an average of more than three-fourths clover in the hay. The results for 4 years show a difference of only

91 lbs. in the yield of hay from medium red clover and from a mixed crop of clover and timothy.

Red clover also gave promise of good seed production, while clover from southern-grown seed or from most of the foreign sources was less satisfactory. Red clover alone and grown with timothy as a mixed hay crop gave in 10 trials an average yield of 3,376 lbs. of hay per acre. The average yield of hay from Mammoth clover for 2 years was 3,635 lbs.

Notes are given on trials with alsike and white clover, berseem, and melilotus. Alsike proved more resistant to the winter than Mammoth clover.

Corn. Field tests, J. N. HARPER (*Kentucky Sta. Bul. 118, pp. 19, pls. 13*).—The results with 15 varieties of corn grown in 1903 and 1904 are reported.

With a few exceptions, the same varieties were grown each year. In 1903 the yields ranged from 27.9 bu. per acre for Iowa Silver Mine, to 35.7 bu. for Boone County White obtained from Indiana. Boone County White from Tennessee yielded 33.5 bu. per acre. Cocke Prolific, which stood second in yield, and Mosby Prolific ranking next to the lowest, were the latest varieties, ripening September 28, while Iowa Silver Mine was ripe September 10. Mosby Prolific led in the yield of fodder with 5,994 lbs. per acre.

In 1904 Champion White Pearl stood last with a yield of 34.6 bu. per acre, and Boone County White from Indiana first, with 50.6 bu. Boone County White from Tennessee produced 46.7 bu. per acre this season. Champion White Pearl, Iowa Silver Mine, Riley Favorite, and Leaming Yellow began to tassel July 12, while Mosby Prolific, Sanders Improved, Cocke Prolific, and Hannah did not begin to tassel until July 23, and Roseland White not until July 27. In yield of fodder Roseland White, which stood second in yield of grain, ranked first with 4,222 lbs. per acre, being followed by Mosby Prolific with 4,171 lbs. A general discussion is given on the culture of corn and the different varieties tested are described.

Experiment station work in corn culture, J. I. SCHULTE (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 493–544*).—A summary of experiments in corn culture by the different experiment stations of the country.

Soil improvement for the Illinois corn belt, C. G. HOPKINS (*Illinois Sta. Circ. 96, pp. 16, figs. 5*).—The experiments reported were conducted on a dark-brown silt-loam prairie soil, which had been in pasture from 1876 to 1894, and in corn from 1895 to 1897. The land had been divided into 7 strips or series of 10 one-tenth-acre plats each, and the 3 series numbered 100, 200, and 300 were irregularly cropped but chiefly with clover, oats, and cowpeas, from 1898 to 1900, while the other series continued in corn.

The following systems of cropping were begun in 1901: A 3-year rotation of corn, oats, and clover on series 100, 200, and 300; a 2-year rotation of corn and oats on series 400 and 500; and corn only on series 600 and 700. The different plats receive different fertilizer treatment. Lime is given in the form of ground limestone at the rate of 2,000 lbs. per acre once every 6 years. Nitrogen in the form of dried blood is applied annually to certain plats in series 600 and 700 at the rate of 100 lbs. per acre.

On the series 100 to 500, nitrogen is supplied only by growing leguminous crops or catch crops, or by the use of barnyard manure. To supply phosphorus 600 lbs. of steamed bone meal is given once in 3 years in the 3-year rotation, and 400 lbs. every 2 years in the 2-year rotation and also in the continuous corn series. This furnishes annually 25 lbs. of phosphorus per acre. On some plats an equal money value of rock phosphate is substituted for the bone meal. Potassium sulphate or chlorid is given in quantities supplying 40 lbs. of potassium per acre each year.

The tabulated results show that, in 1904, 4 duplicate plats in the 3-year rotation gave an average increase of 31.5 bu. per acre over the corresponding plats in the 2-year series. On the plats growing corn continuously lime produced a gain of 5 bu. per acre, lime and nitrogen of only 4 bu., but lime, nitrogen, and phosphorus a gain

of 32 bu. In the 2-year rotation a gain of at least 11 bu. per acre, and in the 3-year rotation an increase of 10 bu. in corn and oats, and of 100 per cent in the yield of clover, is considered due to phosphorus.

The results of pot experiments with wheat showed that with clover turned under, rock phosphate gave a greater increase than the gains made by the clover and rock phosphate separately. Similar results were secured with clover and steamed bone meal, also with bone meal and potassium, and with rock phosphate and potassium. With other combinations this was not the case. The potassium apparently increased the availability of the phosphorus in the bone meal and the rock phosphate. Slightly better results were obtained with rock phosphate than with bone meal.

The latest corn yields on the university soil experiment fields, partly under test since 1876, indicate the great value of suitable crop rotations, but that these alone do not maintain fertility. Directions for soil management are given.

Report on the comparative merits of varieties of oats, 1903-4, R. B. Greig and J. Hendrick (*Aberdeen and No. of Scot. Col. Agr. Bul. 2, pp. 37*).—These experiments, conducted in Morayshire and at Ross and Cromarty, were made for the purpose of determining the grain and straw producing power of different oat varieties, their comparative milling quality, and the composition of the grain and straw.

The following varieties were grown in the Morayshire experiment: Potato, Newmarket, Storm King, Sandy, Waverly, Goldfinder, Banner, and Siberian. Potato and Sandy are two well-known old varieties which were included for comparison with the newer sorts. The tests were carried out on 3 different farms. Banner was the best grain producer on light land and the best average grain producer on all the farms. Storm King, Potato, and Sandy, mentioned in the decreasing order of yield, stood at the foot of the list.

Banner produced 33 bu. more of first quality grain than Sandy and 20 bu. more than Potato. The average total yield of Banner was 88 bu. and that of Sandy 63.25 bu. In weight of straw produced Potato ranked first, while Banner did not rank very high in this respect. Siberian and Newmarket showed themselves good general purpose, or intermediate varieties, in the production of grain and straw. The earliest variety, Storm King, required 136 days to mature and Goldfinder, the latest, 160 days. Banner and Sandy stood nearest the average in the length of growing period.

In the Ross and Cromarty trials the same varieties, with the exception of Siberian, which was replaced by Hamilton, were grown on 7 different farms. The average total yield of grain was in favor of Hamilton. A comparison of the results on 5 of the farms shows that Hamilton gave an average yield of 79.75 bu., as compared with 69 bu. for Potato; and in these tests Banner and Potato produced the same quantity of grain, but Potato furnished the larger yield of straw. The season was not favorable, and the average weight per bushel of grain as compared with that of the original seed showed a reduction in all varieties except Banner.

In these tests Sandy and Potato ranked high as grain producers and also stood among the 3 first in the yield of straw, Hamilton standing second. The percentage of oatmeal obtained from each variety at each of the places is given in a table. Sandy and Newmarket ranked first with 57.8 and 57.6, respectively, while Hamilton on the average of 4 farms furnished only 53.4 per cent. The percentages of husk and kernel and the composition of the kernels of the different varieties, as well as the composition of the straw, is given in tables. The percentage of kernel ranged from 71.27 in Storm King to 77.13 in Sandy.

Varieties of potatoes, W. Bruce (*Edinb. and East of Scot. Col. Agr. Bul. 6, pp. 4*).—Six varieties of early and 7 varieties of late potatoes were tested at 3 different farms in 1904. In each case Pink Blossom, Factor, Up-to-Date, Twentieth Century, and British Queen gave the best results when both quantity and quality are considered. Langworthy is unequaled in quality, but proved to be low in yielding power.

The manuring of swedes and potatoes, 1904, C. B. JONES (*Armstrong Col., Newcastle-upon-Tyne, Agr. Dept. Bul. 1, pp. 18*).—Cooperative fertilizer experiments with swedes and turnips were conducted to ascertain the fertilizer requirements of the crops and of the different soils, to compare the value of barnyard manure and commercial fertilizers and of basic slag and superphosphates, and to determine the best application of commercial fertilizers to be made in combination with barnyard manure.

The best average results were obtained from the use of 1 cwt. of nitrate of soda, ¾ cwt. of sulphate of ammonia, 4 cwt. of superphosphate, 2¾ cwt. of slag, and ⅞ cwt. of muriate of potash per acre. This application supplied 35 lbs. of nitrogen, 100 lbs. of phosphoric acid, and 50 lbs. of potash. Superphosphate gave a slightly better yield than basic slag, but was not quite so profitable, while a mixture of the two was more profitable than either applied alone. Barnyard manure was not as effective as commercial fertilizers, and their use in combination was unsatisfactory.

For potatoes potash was the most important element, and sulphate and muriate of potash were generally more satisfactory than kainit. The results also indicated that where commercial fertilizers alone are used a complete application, consisting of 1⅛ cwt. of nitrate of soda, ⅞ cwt. of sulphate of ammonia, 3 cwt. of superphosphate, and 1 cwt. of muriate of potash per acre, furnishing 40 lbs. each of nitrogen and phosphoric acid and 60 lbs. of potash, is to be recommended. Barnyard manure gave better results this season than commercial fertilizers. The combined use of barnyard manure and commercial fertilizers is considered profitable for potatoes, and an application of 12 tons of barnyard manure, 1⅛ cwt. of nitrate of soda, ⅞ cwt. of sulphate of ammonia, 3 cwt. of superphosphate, and 1 cwt. of muriate of potash is suggested for use.

In a fertilizer test with mangels, reported by W. T. Lawrence, 1½ cwt. of nitrate of soda was more effective than an application of ¾ cwt. of nitrate of soda, 1 cwt. of superphosphate, and 1½ cwt. of kainit, the money value of the two applications being the same.

Quality in potatoes, J. W. GILMORE (*New York Cornell Sta. Bul. 230, pp. 501–525, figs. 11, dgm. 1*).—This bulletin compares the estimates of quality in potatoes in this country and Europe, and reports the results of investigations to determine the principal factors influencing the flavor of potatoes and their mealiness when boiled. Similar work in France, previously noted, is reviewed (E. S. R., 9, p. 263).

It is pointed out that in the United States a tuber of a starchy flavor, white and floury in color, and mealy when cooked is desired, while in France, as the published data seemed to indicate, potatoes retaining their form, yellowish in color, and soggy after boiling are preferred. The trade estimates of quality as based on size, surface aspects and shapeliness, and variety considerations are explained. The market calls for tubers ranging from 2 to 3 in. in length and weighing from 5 to 10 oz.

In the North light yellow or whitish-skinned tubers are often preferred, while in many parts of the South a pink skin is liked best. Generally a more or less netted skin with a corky appearance or touch is more desirable than a smooth and clear skin. Tubers with deep eyes and otherwise uneven on the surface are avoided and those of oval, flat-round, and elongated-oval shape selected. As potatoes are grown principally for table consumption in the United States, it is suggested that mealiness in cooking, color, and flavor be considered as the chief factors in estimating the quality.

The results of 2 years' work indicate that good cooking quality in potatoes depends largely upon (1) the daily range of soil and atmospheric temperature during the growing period; (2) the degree of ripeness of the tuber when the plant dies; and (3) the physical condition and type of the soil. The different parts of the tubers were studied and the bearing of the internal and external characteristics upon the quality is noted. It was found in boiling tubers of 4 different varieties that in 3 cases the

loss in moisture ranged from 1.87 per cent to 6.29 per cent, while in the fourth there was a gain of 0.48 per cent. In baking tubers of 3 varieties the loss in moisture ranged from 12.79 to 20.76 per cent.

The investigations on the depth and time of planting, and the temperature of the air and of the soil in their relation to quality, pointed out that the seed should be planted 5 to 6 inches deep in good soil, in order to provide room enough between the seed and the surface of the ground for the development of the number of tubers the plant is capable of producing. The tubers growing from 1½ to 4 in. deep were of more uniformly good quality than those growing either deeper or shallower. The results seemed to show that good quality is developed under a uniform soil temperature of 65 to 75°.

It was further found that long tubers which grew sloping in the ground showed a difference in cooking quality between the 2 ends, the stem end cooking more mealy than the bud end, which in these instances is generally nearer the surface of the soil. Incidentally the station observed that in 1904 a fine sandy loam produced potatoes of good quality, while under identical conditions a poorly drained clay loam yielded potatoes which remained firm and soggy after boiling and were very poor in flavor.

Irrigation experiments of 1905, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 14, pp. 17, dgm. 1*).—These experiments were begun in 1901 (E. S. R., 15, p. 960).

The harvest of 1905 formed a ratoon crop from the planting of 1901. The data for the ratoon crop of 1903 are also given. The Lahaina variety produced the largest weight of cane for both crops with 3 in. of water per week, the average yield being greater by 43,415 lbs. per acre than on the plat receiving only 1 in. per week. The plants given weekly applications of water produced the following yields of cane per acre: One in. per week, 134,491 lbs.; 2 in. per week, 160,395 lbs.; and 3 in. per week, 177,906 lbs. As compared with the use of 1 in. per week, the average figures for 2 in. of water applied every 2 weeks and 3 in. applied every 3 weeks show a loss in yield per acre of 2,730 and 14,030 lbs., respectively.

The plant crop of Rose Bamboo was greatest where 3 in. of water per week was used, and the ratoon crop where 2 in. were applied. Comparing the average yields for the 2 crops, the 2-in. per week plat gave 32,873 lbs. and the 3-in. per week plat 16,604 lbs. of cane more per acre than where only 1 in. per week was applied. The general average for the 2 varieties and the 2 crops shows but a small difference in yields of cane between the plats receiving 2 and 3 in. per week.

The method of irrigation and the different amounts of water applied were apparently without effect on the quality of the juices. The largest yields of sugar, as a rule, were secured from the heaviest yields of cane, but in 2 instances, owing to a lower percentage of sucrose in the juice, plats ranking first in yield of cane did not produce the largest yields of sugar. Lahaina produced the greatest amount of sugar with 3 in. of irrigation water per week, and Rose Bamboo with 2 in.

The plant and ratoon crop of Lahaina with 1 in. of water per week, or 1,632,219 gal. in addition to 1,926,502 gal. of rainfall, gave an average yield of 22,560 lbs. of sugar per acre. As compared with this result, 2 in. of water per week gave a gain of 3,758 lbs. of sugar, and 3 in. a gain of 7,862 lbs. per acre, or 1 lb. of sugar for each additional 448 and 418 gal., respectively. The average results of the plant and ratoon crops of Rose Bamboo show a distinct loss in sugar production when 3 in. instead of 2 in. of water per week were used. The plant cane crop of Lahaina showed a gain of only 2,333 lbs. of sugar on increasing the irrigation from 1 in. to 2. in. per week, and an average gain for the 2 crops of 7,862 lbs.

The results in general call attention to the different water requirements of the 2 varieties and the necessity of basing conclusions upon more than one crop test.

Fertilizer experiments, 1897–1905, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 15, pp. 57, dgms. 10*).—These experiments, which have been previously noted (E. S. R., 15, p. 960), are conducted on 20 plats, including 2 check plats.

Lahaina and Rose Bamboo sugar cane are grown, 10 plats being devoted to each variety, and the essential plant-food elements, furnished either singly or in combination, are each applied at the rate of 100 lbs. per acre. Analyses of the station soil and of average soils on the 4 principal islands are reported. The data secured during the 8 years are tabulated in detail and discussed.

The results with respect to purity of juice for both varieties show that the highest purity, 90.69 per cent, was obtained on the unfertilized plats, and the lowest, 88.29 per cent, on the plats receiving a complete application with the nitrogen in the form of sulphate of ammonia. The highest sucrose content, 18.26 per cent, was also secured on the unfertilized plats, and the lowest, 16.40 per cent, on the plats given a complete fertilizer with the nitrogen in the form of dried blood. The average yields of sugar for the 2 varieties, together with the percentage of gain or loss from fertilization, are given in the following table:

Comparison of plat yields by four-year periods.

Fertilization.	Yields of sugar per acre.			Gain or loss from fertilization.	
	First period.	Second period.	Difference for second period.	First period.	Second period.
	Pounds.	*Pounds.*	*Per cent.*	*Per cent.*	*Per cent.*
No fertilizer	21,458	15,974	25.6		
Nitrogen	25,047	19,348	22.8	+16.7	+21.1
Phosphoric acid	22,241	13,633	38.7	+ 3.6	−14.7
Potash	24,593	14,182	42.3	+14.6	−11.2
Nitrogen and phosphoric acid	26,464	20,533	22.4	+23.3	+28.5
Nitrogen and potash	29,119	21,478	26.2	+35.7	+34.5
Complete fertilizer	27,379	23,438	14.4	+27.6	+46.2

These experiments have shown that lands capable of producing 11 tons of sugar per acre without fertilization, may be profitably fertilized under favorable climatic conditions and a sufficient water supply. Mixed fertilizers produced a greater percentage of gain as the soils suffered a gradual exhaustion. Rose Bamboo cane seemed to require a larger supply of phosphoric acid in the soil than Lahaina, while Lahaina responded more to an increased supply of potash than Rose Bamboo. Both varieties showed considerable gain from the use of nitrogen, in which the soil was below the average for the islands.

On land much richer in phosphoric acid than the average soil, Rose Bamboo gave larger yields when phosphoric acid and nitrogen were applied together than when nitrogen was given alone, but Lahaina under the same conditions gave about equal yields. On soil containing about the same quantities of potash as an average island soil both varieties gave increased yields when this element was applied with nitrogen. It was also found that the separate use of phosphoric acid in soluble forms on soil already rich in this element may result in a loss of sugar, and that apparently the chances of loss are greater with Lahaina than with Rose Bamboo, where both make an equally thrifty growth under normal conditions.

Separate applications of potassium sulphate to lands under cane also sometimes decrease the yields of cane, and the danger of loss seems greater with Lahaina than with Rose Bamboo. A particular element given alone may produce negative results, but it may be very effective in increasing the yields when applied with some other element. The unfertilized areas produced the purest juice, and, in general, the

plats receiving incomplete fertilizers yielded juices of greater purity than those treated with complete applications.

Wheat growing, F. C. BURTIS and L. A. MOORHOUSE (*Oklahoma Sta. Bul. 65, pp. 35*).—Wheat experiments at the station were begun in 1892. The results up to 1901 have been previously noted (E. S. R., 12, pp. 846, 850), and those secured since that date are reported in this bulletin. A summary for the entire period is given.

A half-acre plat receiving 7.5 tons of barnyard manure the first year of the test and 5.5 tons the second year yielded from 6 consecutive crops 82.9 bu. of wheat, as compared with 53.1 bu. on a like plat without manure. The first and second years the manured plat yielded 18.6 and 18.7 bu. more per acre, respectively, than the unmanured plat, but the last year there was a difference of only 3.1 bu. in its favor. Nearly 2½ bu. of wheat was obtained for each ton of manure applied per acre. In isolated experiments of this kind an average yield of 32.4 bu. from manured land and of 14.4 bu. per acre from unmanured land was obtained in 1894, and of 27.5 bu. from manured land and 14.5 bu. from unmanured land in 1899. These experiments were made on practically virgin soil.

In a test covering 5 consecutive years plats plowed the middle of July averaged 27.1 bu. per acre; plats plowed the middle of August, 24.2 bu., and those plowed the middle of September, 22.1 bu. In July the ground was free from weeds and in better condition for plowing than later in the season. The early plowing also formed the best seed bed.

Experiments on the time of seeding, carried on for 5 seasons from 1899 to 1904, gave an average yield of 24.28 bu. per acre on plats seeded September 10 to 20, 27.49 bu. on plats seeded October 10 to 20, and 17.38 bu. on those seeded November 10 to 20. The late-seeded plats, generally severely damaged by rust, produced the poorest quality of grain. Seeding late in November gave in one experiment an average of only 5.4 bu. per acre, the grain weighing only 45 lbs. per bu. The best results were secured from seedings made from September 20 to October 10.

The results with different quantities of seed per acre show that 5 to 6 pk. per acre usually gave better yields than 3 to 4 pk., but differed but little in yield from the use of 8 pk. In general, moderately thick seeding, or the use of about 6 pk. per acre, is considered safest.

In 2 years' work on pasturing wheat the plats not pastured averaged 2.45 bu. per acre more than plats pastured until March 1, 3.5 bu. more than plats pastured until the end of March, and 9.66 bu. more than those pastured to the middle of April. Late pasturing retarded ripening and made the wheat more subject to rust. When wheat is to be pastured, seeding 10 days earlier is recommended if later seeding is not necessary to avoid insect attacks.

The following varieties, most of them tested from 8 to 10 years, are considered good varieties for Oklahoma: "*Soft smooth wheats*—Early Red Clawson, Fultz, and German Emperor; *soft bearded wheats*—Fulcaster, Missouri Bluestem, and New Red Wonder; *hard smooth wheats*—Red Russian and Oregon Red; and *hard bearded wheats*—Sibley New Golden, Turkey, Weissenburg, Crimean, and Theiss." None of these varieties belong to the durum wheats.

Soil treatment for wheat on the poorer lands of the Illinois wheat belt, C. G. HOPKINS (*Illinois Sta. Circ. 97, pp. 22*).—The management of this particular class of soil is discussed and 4 years' results on 4 soil experiment fields in southern Illinois are reported. The plan of these experiments has been previously described (E. S. R., 15, p. 469). In 1905 an average yield of 29 bu. of wheat was secured on treated soil, and only 9 bu. on untreated soil.

On the Odin field in 1904, an undrained plat on which leguminous crops are grown and lime and phosphorus applied, produced 21.6 bu. of wheat per acre, of which 7.9 bu. are credited to the land and 13.7 bu. to the treatment. On the corresponding tile-drained plat 21.5 bu. per acre was secured, 6.7 being credited to the untreated

land and 14.8 bu. to the soil management. It is estimated that 1.8 bu. of this increase of 14.8 is due to the growing of leguminous crops, 1.1 bu. to the use of lime, and 11.9 bu. to the phosphorus applied.

On the Cutler field on undrained land the same treatment increased the yield of wheat from 7.9 to 17.6 bu. as an average for 3 years. On the plats receiving potassium in addition, the average was further increased by 4.6 bu., which was a more marked effect than that produced on the other fields.

The data secured in 1904 on the Cutler and DuBois experiment fields, where nitrogen was applied at the rate of 100 lbs. per acre in the form of dried blood, in place of growing leguminous crops, show that the land produced 6.2 bu. while the lime increased the yield 3.3 bu., the nitrogen 0.5, the phosphorus 16.6, and the potassium 0.6 bu., giving an average of 27.2 bu. of wheat per acre for 3 tests. It is believed that the first beneficial effect of leguminous crops on this soil was not due solely, or even largely, to the fixation of nitrogen, but rather to the liberation of phosphorus and to the improved physical condition of the soil as brought about by the chemical action of the decaying organic matter of these crops.

The results on the Vienna soil experiment field showed that in 1904 the yield was increased from 6.7 bu. on the untreated soil to 10 bu. on soil growing leguminous crops and treated with lime, and to 14.8 bu. when phosphorus was also given. In 1905, where lime had been applied to correct soil acidity and leguminous crops had added nitrogen and decaying organic matter, the yield was increased from 1.3 bu. on untreated soil to 18.2 bu. per acre with leguminous crops and lime treatment; and where phosphorus was added a further increase of 7.4 bu. was obtained.

It is estimated that during the 3 years the untreated land produced 8.4 bu., the growing of leguminous crops gave an increase of 10.1, the lime treatment an increase of 10.4, and the phosphorus treatment an increase of 19.5 bu., or a total yield of 48.4 bu. The results of 4 years' experiments with pot cultures on unglaciated hill soil showed that an appreciable increase in yield was made only when nitrogen was supplied either in commercial form or by means of growing leguminous crops.

A summarized statement is given showing the yields and value of the wheat produced on the different soil experiment fields. The average yield of wheat in 1903 was 1.9 bu. per acre on the untreated land and 11.9 on the treated land, while in 1904 the yields were 7.6 bu. and 10.5 bu., respectively, or a total of 18.1 bu. on the treated land. In 1905 the treated land produced 28.9 bu. and the untreated land only 9 bu. In 12 tests covering 3 years' work the untreated land yielded on an average 6.1 bu. and the treated land 19.6 bu., the use of leguminous crops and the application of lime and phosphorus being responsible for this increase of 13.5 bu. The cost of the soil treatment, allowing 50 cts. an acre a year for ground limestone and \$2.50 an acre a year for the cost of 200 lbs. of steamed bone meal, is given at \$3 per acre, but it is pointed out that if raw rock phosphorus at \$8 a ton is substituted for the steamed bone meal the total annual expense for materials may be reduced to \$1.70 an acre.

Data on the effect of the soil treatment on corn, oats, and clover indicate that during the first 3 years on the different fields the use of leguminous crops, lime, and phosphorus increased the yield of oats 13.2 bu. per acre. As a result of this treatment an average increase of 13.3 bu. of corn was secured in 6 tests made in 1904, and an increase of 1.14 tons per acre of field-cured clover hay as due to this method of soil management was obtained in 1905 in 5 different trials. The value in the increase in each of the crops was more than enough to pay for the annual cost of the materials.

An experiment showing the comparative value of steamed bone meal and finely ground rock phosphate is noted in the abstract of Circular 96 (see p. 356).

HORTICULTURE.

Report of the horticulturist, B. D. Halsted (*New Jersey Stas. Rpt. 1904, pp. 291–340, pls. 4*).—An account of greenhouse experiments with tomatoes and cauliflower, observations on the weather during the year, and data for the yields of asparagus, small fruits, and vegetables on the permanent plats at the station. The latter has been a prominent feature of previous reports (E. S. R., 16, p. 463). The winter of 1903–4 was especially severe and caused considerable injury to small fruits. The rainfall was unusually abundant throughout the season.

From work done at the station in the greenhouse with tomatoes for a number of years, it is estimated that the expense of caring for a house 100 by 20 ft. is about $300 a year. The average yield of marketable fruit per square foot for 6 years has been 32.33 oz. and the average price 24.3 cts. per pound. The net profit from a house of this size is placed at $428.55 a year.

On the basis of the station work, the following method of growing the crop is advocated: Soil for the benches should be made up of 3 parts turfy loam, 2 parts manure, and 1 part sand, and 2 sq. ft. allowed per plant. The best varieties for forcing are Lorillard and Best of All. These should be 7 or 8 weeks old when set out and trained to single stems. The best fertilizer for tomatoes is solid and liquid cow manure, fresh and directly from the stables, applied to the surface at the rate of 244.64 oz. per 100 sq. ft., or where subwatering is practiced at the rate of 214.28 oz. liquid manure per 100 sq. ft. To prevent root gall frozen sterile earth is used. For dropsy good ventilation and not too much water and heat on dull winter days is recommended. The Aleurodes are controlled by spraying with a mixture made of 1 lb. whale-oil soap and 6 gal. of water added to 1 lb. of tobacco stems in 2 gal. of water. For rot, clean, well-ventilated houses, uniformly heated to 65° F. at night and 75 to 85° F. during the day. Before the houses are filled they are smoked for 2 days with sulphur to kill any spores from the crop of the previous year. The benches are then filled with frozen earth and the plants set, after which they are smoked with tobacco powder to kill whatever insects may be brought in with the plants. Many of the details on which the above conclusions are based are recorded in tabular form and otherwise.

The culture of cauliflower in the greenhouse has been less profitable than that of tomatoes. The average price for 3 years' sales has been at the rate of $1.44 per dozen or 15.8 cts. per square foot of space, while with tomatoes the returns have been 48.6 cts. per sq. ft. With this crop, however, less expensive houses are required and much less care and attention. The only crop of cauliflower which has been found profitable is that which matures heads in April from plants set in the benches in December.

The temperature for this crop should range from 50° F. at night to 70° F. on bright days. Plants give the best returns when allowed about 290 sq. in. each of bench surface and allowed about 42 oz. of manure per 100 sq. ft. on solid beds made up of 16 in. of either sand or soil, and 22 oz. when shallow beds 8 in. deep are employed. The crop is not seriously troubled with diseases or insects. Phosphate of potash has been found superior to muriate of potash and phosphoric acid for this crop. Manure should be used to supplement commercial fertilizers for cauliflower.

On the permanent asparagus plats Palmetto still stands as the best average variety. Unirrigated plats have given better yields than irrigated plats. Selected crowns have not proved superior to ordinary crowns. The largest total and early yields have been obtained on the plat fertilized with barnyard manure at the rate of 20 tons per acre.

Cuthbert was the only variety of raspberry during the year which yielded fruit. The yields obtained with the different fertilizers are tabulated, but no conclusions drawn. Of the blackberries the largest total and early yield was secured on the

manured plat, the plat fertilized with complete fertilizer standing second. The early yield was a little larger on the irrigated plats, but the total yield was much greater on the unirrigated. Agawam and Taylor came through the winter in best condition.

The manured plat of gooseberries has also given better results both with and without irrigation than any combination of commercial fertilizers. With currants the manured plat also stood first. With strawberries, the plat receiving the complete fertilizer with an additional amount of nitrate of soda after blossoming stood first. In both early and total yields the irrigated plats led over the unirrigated. In early yield Glen Mary led with Bubach second.

The yields of apples, peaches, standard and dwarf pears, plums and cherries on plats which are being treated with different fertilizers are recorded but no conclusions drawn. Pears are grown as dwarfs, as dwarfs by cutting, and as standards. Kieffer dwarfs by cutting bore during the year an average of 493 fruits per tree, weighing 152 lbs. 9 oz., while Kieffer standards bore 938 fruits, weighing 252 lbs. 2 oz. per tree. On an acre basis, however, it is calculated that the dwarfs would give an increased yield of 45 per cent due to closer planting than the standards, besides they are preferable from the standpoint of harvesting and of beauty of tree. Being more compact, the branches are also less likely to be broken down by the weight of the fruit.

Bartlett and Lawrence varieties also stand in favor of dwarfs against the standards, but a difference between dwarfs proper and dwarfs by cutting has not yet been definitely established. The Lawrence variety dwarfs by cutting came into bearing a year later than the dwarfs proper.

Report of the botanist, B. D. HALSTED, E. J. OWEN, and J. K. SHAW (*New Jersey Stas. Rpt. 1904, pp. 447–553, pls. 12, figs. 3*).—A leading feature of the work of the year has been the crossing of plants and the growing of hybrids secured in earlier work (E. S. R., 16, p. 464).

The Voorhees Red sweet corn, originated by the station, was distributed to farmers in considerable quantities, and notes from them on the character and quality of the corn as grown during the season are reported. From these reports it appears that the corn is medium large, usually bears 2 ears, and the quality good to excellent. Further notes are given on the cross between Black Mexican and Country Gentleman sweet corn. In these reciprocal crosses the male parent has controlled to a large extent the character and color of the ear.

A study was made of a large number of varieties of sweet corn obtained from different seedsmen throughout the country. These were grown at the station, and notes are given upon their tendency to intercross, especially that of Black Mexican, together with a proposed classification of sweet corn. Some data are incorporated on experiments with conspicuously colored varieties of sweet corn and their tendency to intercross. The Malakhov sweet corn, introduced by this Department from Russia, was sent to a number of growers in the State. This corn appears to have small stalks, with from 1 to 4 ears per stalk. The quality was reported excellent or good.

A second crop of sweet corn was grown in one instance from the matured seed of the first crop. The output of ears of the second crop was small and no seed matured. Apache corn, grown by the Indians of the arid regions of the Southwest, produced an ordinary crop, and it is thought that it may be of some value as a breeder with eastern sorts, especially for corn grown in sandy soils on dry situations.

Six kinds of squashes have been intercrossed and the fruits of some of the results obtained are illustrated, as well as the seeds. The Jersey Belle eggplant, originated by crossing New York Improved Spineless and Early Long Purple, has been grown another season, producing plants very uniform in color and other characteristics.

This variety is considered valuable because of its earliness and the large proportion of fruit which is without seed.

A test was made of a large number of tomatoes. The yields obtained on different dates are tabulated, and the fruiting season, size of fruits, popularity, and other characteristics of the different varieties noted. A scale of points for judging the merits of ordinary tomatoes was devised and its use is illustrated in scoring the varieties grown. In this score card 50 points are given to the fruit and 50 to the plant. The score for the different points is allotted as follows: Size of fruit 4, shape 4, surface 7, skin 3, color 3, cells 7, flesh 7, flavor 5, seeds 5, and decay 5. For the plant the scale is: Form 5, vigor 10, foliage 10, product 15, and disease 10.

A proposed classification for tomatoes is also given, and various varieties classified according to the scheme. A second crop of tomatoes was grown from the seed of some of the earliest varieties to mature. This second crop attained full size, maturing seeds.

Tests were made of bush and pole Lima beans, green-pod bush beans, and wax beans. Classifications are given for green-pod beans and for wax beans, with illustrations of the pods and beans of the different varieties tested. For each variety the weight of vines, weight of pods, number of pods, seeds per pod, and popularity are noted. Considerable work was done in the crossing of beans during the season, but it will require another season to determine the success of the crosses, since beans are easily self-fertile.

Data are also tabulated for weight of vines and pods, and number of pods and seeds in 3 varieties of peas, in which seed of each variety obtained from Canada was compared with the same variety when grown in New York.

Further notes are given on the colors of the blooms of salsify hybrids under cultivation and from self-sown seed. The proportion of each of 9 lawn grasses sown in the mixture in 1896 is noted for each of the years since that date. Likewise, the proportion of weeds on the plat of soil which has been undisturbed since 1897 are recorded.

In a test of Early Snowball cauliflower seed from Denmark, the State of Washington, and an eastern locality, the best results were obtained from the seed grown in the State of Washington.

In experiments with tulip bulbs, American-grown bulbs gave finer flowers and were longer in bloom than foreign bulbs. Notes are given upon *Aralia cordata* as a salad plant, nasturtiums, and the report blanks used by this Department in descriptions of tomatoes.

The usual notes upon the weather are given, showing the rainfall, temperature, and sunshine for the growing season of each of the past 16 years. The condition of crops and the relation of fungi to weather, as shown in the weather and crop bulletins issued weekly by the State weather service during the growing season, are noted with special reports from correspondents in 21 different counties of the State, showing the winter injury to vegetables, fruits, and field crops in various sections.

Results of experiments in production and marketing fruits and vegetables, and canning fruits and vegetables on a small scale, at the North Louisiana Experiment Station, D. N. BARROW and E. J. WATSON (*Louisiana Stas. Bul. 81, 2. ser., pp. 36, pl. 1, figs. 2*).—In order to obtain results of commercial importance and also to encourage farmers in the neighborhood to engage in the shipping of fruits and vegetables, a number of vegetables were grown at the station during the season in considerably larger quantities than heretofore. These were shipped in cooperation with the farmers of the neighborhood in carload lots.

From seven-eighths of an acre of tomatoes 236 crates were shipped and about 60 crates were canned. The average net return was about 50 cts. per crate, and the cost of growing an acre from seed bed to market was placed at $50. From one-eighth

of an acre in cabbage 16 crates weighing about 175 lbs. per crate were obtained. The cost of production is placed at $40 per acre. The season for string beans was unfavorable. From one-fourth of an acre 18 bu. was obtained. The price received averaged 50 cts. per bushel net; and the cost of growing an acre is placed at about $20.

From one-eighth of an acre of radishes 820 bunches containing 6 to 10 radishes per bunch were obtained. The first planting of bush Lima beans proved unsatisfactory. From the second planting made the first of June 24 bu. of dry shelled beans were obtained, worth $2 per bushel. The expense of growing muskmelons is placed at $30 per acre and watermelons at $20 per acre. From 3 to 5 salable watermelons were obtained per hill. The melons were of good size, averaging 24 lbs. per melon. No shipments were made.

Squashes cost about $20 per acre. Early Bush yielded about 70 bu. and Crookneck about 66 bu. per acre. One small shipment of Early Bush netted about 75 cts. per bushel crate. One-eighth of an acre of okra was grown but no shipments were made of this crop. Considerable quantities, however, were successfully canned, the resulting product being of high quality. By keeping the mature pods pulled off the crop lasted through the entire season. About 60 bu. per acre was obtained.

Peas were grown only on small areas. They did so well, however, that one small shipment was made which sold for 50 cts. per bushel. The yield of onions was at the rate of 86 bu. per acre which had a market price of $1.50 per bushel. The results of variety tests with a number of the vegetables mentioned above are included in the notes, as well as the results of variety tests with peaches, plums, apples, pears, strawberries, and figs.

In the canning experiments two $10 outfits were used, each having a capacity of 300 2-lb. cans and 200 3-lb. cans per day. With these 2 outfits the cost of canning 600 2-lb. cans of tomatoes daily was placed at $21.40. The net price for the canned product was 70 cts. per dozen or $35, leaving a balance of $13.60 per day. The cost of 400 3-lb. cans of peaches was $20.40. These sold for $1.75 per dozen, or a total of $58.33, leaving a net balance of $37.93 per day.

Pears were found even more profitable than peaches, since a bushel of pears filled an average of 24 3-lb. cans, while a bushel of peaches filled only 16 3-lb. cans. It is believed that canning may be profitably employed in utilizing the surplus that can not be profitably shipped to market.

Where king watermelon reigns supreme (*Cal. Cult., 24 (1905), No. 19, pp. 435, 450, fig. 1*).—The author of this article made a trip to the Glendale-Burbank melon section in the region of Los Angeles, and describes the methods of watermelon culture followed in that district.

The vines are planted 12 by 12, 10 by 14, and 8 by 16 ft. apart, each of these different distances having adherents. The Chilean White is the variety chiefly grown. In addition a few Georgia Rattlesnakes and Kleckley Sweets are grown. Before planting the seeds are soaked for about 12 hours in warm water and most growers sprout them before planting.

Sprouting is accomplished by digging through a pile of warm manure down to the ground, spreading the seeds in sacks so that they are about 1 in. deep, covering them with warm manure, and leaving them there until sprouted, after which they are planted immediately. Where manure is scarce a fire is sometimes built on the ground to warm it. The ashes are then scraped away and the seeds buried in the warm earth, being covered as before with manure to prevent the escape of heat. One large grower sprouts his seed by placing them in Mason jars and keeping them in warm water. By this latter method it requires on an average about 36 hours to sprout the seed, the time varying with the temperature of the water.

The seeds are planted mostly in raised hills or on backfurrows. Cultivation consists in keeping the weeds down and preserving a dust mulch. The vines are also compacted in the center of the rows as much as possible to shade the melons and

thus prevent sunburn. The chief disease is blight and this is kept under control by planting the melons on new ground at least every second year. Plant lice are controlled by spraying with soap mixtures.

Fall and winter culture of Pé-tsaï, J. CURÉ (*Rev. Hort. [Paris], 77 (1905), No. 6, pp. 148, 149*).—The author gives his results in the winter culture of Pé-tsaï or Chinese cabbage. The plant appears to be nearly as hardy as ordinary cabbage.

Water cress supplies (*Gard. Mag. [London], 48 (1905), Nos. 2685, p. 237; 2686, p. 252*).—An investigation was made, under the auspices of the London County Council, of the water cress beds grown within a radius of 50 miles of London.

One hundred and fifty beds ranging from less than a quarter of an acre to upwards of 40 acres in extent were visited. Of this number 35 beds were not liable to pollution and 67 beds were probably polluted, the water used in the majority of the cases on these beds being about equal in quality to that of the Thames. There were 27 beds that were actually polluted and 11 beds in which there was a gross actual pollution. The possibility of thoroughly cleansing the cress grown in polluted water was investigated.

The results indicate that thorough washing will remove a large proportion of the impurities, but "that no ordinary amount of washing could be relied on to rid cress grown in polluted waters of all undesirable microbes. This may be due either to bacteria so firmly adhering to the exterior of the plant as to resist being swept away during the washing process, or to the cress harboring microbes within its structure, or to a combination of these causes." Under normal kitchen conditions it is believed that the chances for cleaning the water cress would be less favorable than exists in a laboratory.

An apple orchard survey of Orleans County, G. F. WARREN (*New York Cornell Sta. Bul. 229, pp. 461-499, figs. 15*).—This is the second report on this subject. The first report dealt with orchard conditions in Wayne County, New York (E. S. R., 17, p. 41).

The present report presents the results of a similar survey of Orleans County. In this county 564 orchards, containing 4,881 acres, or a little more than one-fourth of the total area in apples in the county, were personally examined with reference to topography, soils, varieties, tillage, drainage, fertilizers, cover crops, pruning, spraying, yields, markets, prices, income per acre, etc. From 70 to 90 per cent of the fruit grown in Orleans County is barreled and sold, while in Wayne County the greater part is evaporated.

Generally speaking, better cultural practices are observed in the apple orchards in Orleans County than in Wayne County. It is believed that greater profit would be obtained by orchardists in Orleans County if greater attention was paid to sorting and grading the fruit and more extensive use made of the apple evaporator.

Briefly, the survey shows that Baldwin and Rhode Island Greening are the leading varieties of apples grown in the county. The 5-year average yield of orchards cultivated 10 years was 86 per cent greater than for orchards 10 years in sod. Apples from tilled orchards have brought slightly better average prices than from orchards in sod. One-fifth of the orchards in sod have given as good results as the average tilled ones, but no method of sod treatment has been found to equal tillage in average yield or income. Cover crops are used in about 3 per cent of the area examined, red clover and buckwheat being the favorite crops for this purpose.

The average income per acre from well-cared-for orchards was as follows: Unsprayed, $103; sprayed once, $139; sprayed twice, $143; sprayed 3 times, $184. In 1904 most of the unsprayed orchards showed about 90 per cent of scabby fruit, while over half of the orchards sprayed 3 times were practically free from scab.

The best orchards were found on loamy soils. Good apples were also grown on quite sandy soil. A loss of 8 to 10 per cent of apple trees was found to be due to poor drainage. The gross income in over half the orchards has averaged over $100 per

acre during the past 5 years. The data in the bulletin supplement that obtained from Wayne County and serve to confirm the recommendations there given as to the best cultural practices to follow.

The avocado, a salad fruit from the Tropics, G. N. COLLINS (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 77, pp. 52, pls. 8*).—The author visited certain parts of Mexico, Central America, and the West Indies, and gives the results of his observations in these regions with reference to the avocado.

The origin, history, and botanical affinities are discussed, and the types found in Guatemala, Porto Rico, Mexico, Costa Rica, Cuba, and Hawaii are noted. The culture of the avocado is considered at length and an account given of some experiments in shipping avocados from Hawaii to New York City. Five crates were thus shipped experimentally in cold storage. They were 30 days in transit. The majority of the samples suffered considerably from the long trip, but some lots were found in good condition, demonstrating that with better knowledge of methods of handling these fruits can be successfully shipped in cold storage providing they are not too long in transit.

Especial interest is attached to the thick-skinned avocados found in Guatemala. These varieties promise to withstand shipment much better than the thin-skinned varieties, and the culture of these in Porto Rico, it is hoped, will aid materially in establishing a profitable industry in that island. The food value of the avocado is discussed by C. F. Langworthy and compared with that of a number of other fruits.

Cooperative experiments with small fruits, H. L. HUTT (*Ann. Rpt. Ontario Agr. and Expt. Union, 26 (1904), pp. 31-38*).—The kinds of small fruits which were sent out by the college to experimenters during the year are given, together with the cultural directions which accompanied them.

The influence of American stocks on the quality of wine, E. HOTTER (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 5, pp. 565-571*).—The effect on the composition of the fruit and on the quality of wines obtained from European grapes grown on their own roots and on American stocks was studied. Nine European varieties were thus compared. The fruit of 7 kinds on American stock contained more acid and 2 kinds less acid than when grown on their own roots. Five varieties of European grapes on their own roots one year and 6 varieties another year contained slightly more sugar than the same varieties on American stocks.

Relative to the wine made, that from grapes on their own roots contained more phosphoric acid than that from grapes on American roots. The results were the same whether the grapes were fermented with the stems or not, or whether the must was pressed immediately or after a considerable period. Tables are given which show in considerable detail the composition of fruit and the wine obtained from each variety of grape during the 2 years of the investigation.

Chinese fruits, G. E. ANDERSON (*Mo. Consular Rpts. [U. S.], 1905, No. 294, pp. 52-54*).—An account of the kinds and value of different fruits most commonly grown in China. For the most part they appear to be much inferior to American fruits.

The persimmon, which is highly esteemed in China, is thought to be less astringent than the American persimmon. It grows large and is a good keeper. The author states that probably the best all-round fruit in China is the pomelo. This resembles the American fruit in size, shape, and color, but is sweeter and has less of the bitter quality, while the flesh is more perfectly separated into sections, as in the case of oranges. It has better keeping qualities than the orange and is strongly recommended to American horticulturists.

The preparation of fruit pulp (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1905, No. 46, pp. 174-176*).—The method of preparing fruit pulp in France for shipment to England, to be manufactured into jams, is given for a number of different kinds of fruit, such as black currants, cherries, raspberries, apricots, plums, and the like.

An experiment was made to determine the length of time that black currants will keep in cold storage when packed at different stages of maturity. When gathered while still green, 15 to 18 days before maturity, they kept perfectly for 1 month and then gradually withered and dried. When gathered some 5 or 6 days before maturity, they kept perfectly for 46 days and were good for 12 days later. Gathered when quite ripe they kept fresh for 26 days, but 9 days later they showed slight signs of withering.

Cold storage for the preservation and transportation of food and horticultural products, VALVASSORI (*Bul. Mens. Off. Renseig. Agr.* [*Paris*], *4* (*1905*), *No. 5, pp. 532–542*).—The author visited a number of cold storage houses in Milan, Frankfurt, Cologne, and Berlin, and gives brief descriptions of the different plants, and in some instances an account of the temperatures observed in the preservation of different products.

At Milan lily of the valley rhizomes are placed in cold storage in May. They are drawn out and forced according to the needs of trade. After withdrawal they produce flowers in about 15 days. The usual period of forcing is from October to January. Lilacs are also kept in cold storage and withdrawn for forcing toward the end of October. They may be withdrawn, however, at any other time in the year.

Other plants retarded in cold storage to be withdrawn when needed are asparagus, strawberries, azaleas, rhododendrons, *Kalmia latifolia*, *Hydrangea paniculata*, *H. hortensia*, Spiræa, etc. In this establishment ripe cherries put in cold storage in June kept well until August; temperature not stated. At Cologne grapes on the stem maintained at a temperature of zero kept in prime condition for 4 months. At Hamburg lily of the valley was kept at a temperature of - 6°.

A new coffee from central Africa, A. CHEVALIER (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 8, pp. 517–520*).—A botanical account is given of *Coffea excelsa*, a tree which grows 18 to 60 ft. high.

Analyses are given of the soil on which it flourishes. The soil is especially rich in nitrogen and soda, and contains only very small amounts of potash, phosphoric acid, and lime. The coffee seeds are small and rounded, taking about 10 to a gram. A wild tree 5 years old measured 8 meters in height and contained 600 fruits. The following analysis is given: Water at 100° 7.66, caffein 1.89, nitrogen 3.11, fat 12.58, and ash 3.75 per cent. The coffee is classed as among the best sorts known at the present time.

How walnuts grow, J. L. BOWERS and F. GILLET (*Pacific Rural Press*, *69* (*1905*), *No. 22, p. 340*).—Two different views are given by these writers on how walnuts sprout and how the seed should be planted in the ground. Mr. Bowers states that nuts should be planted with the point down. Mr. Gillet maintains that walnuts like all nuts should be planted with the suture or seam perpendicular to the line of the horizon—that is, lying on the seam, and never on the face or with the small or big end down.

Home-grown bulbs, A. J. PIETERS (*Amer. Florist*, *24* (*1905*), *No. 888, pp. 908, 909*; *Gardening*, *13* (*1905*), *No. 307, p. 297*).—An account is given of a test on the trial grounds of this Department of certain varieties of narcissus raised in Virginia, in comparison with the bulbs from 3 European houses.

The Virginia-grown bulbs gave decidedly the best results. The bulbs of Emperor gave magnificent flowers, being as large as any seen from the best imported stock. *Narcissus princeps* was also very satisfactory, and *N. poeticus poetarum* just as good as any others, although neither obtained the high standard of Emperor.

FORESTRY.

Report of the chief of the Bureau of Forestry of the Philippine Islands, G. P. AHERN (*Philippine Bur. Forestry Rpt. 1904, pp. 68, pls. 25, map 1*).—This is an account of the inspection service and forest management in the various districts of the Philippine Islands, with a statement of the licenses granted, amount of timber cut, the results secured in the timber-testing laboratory, the forest products of the islands for the fiscal year ended June 30, 1904, average Manila prices of timber and lumber, etc.

Some work is being done in the growing of tropical and deciduous fruits, forage plants, and the maintenance of forest nurseries. The details of physical tests of 13 Borneo woods are also included in the report.

Report on the examination of a forest tract in western North Carolina, F. W. REED (*U. S. Dept. Agr., Bur. of Forestry Bul. 60, pp. 32, pls. 6, map 1*).—This report gives the results of a careful examination of a tract of about 16,000 acres lying in the mountains of western North Carolina.

The prevailing timbers in different parts of this tract are mapped, the products which they will yield noted, and specific directions given regarding their management as a source of revenue and the maintenance of the present natural beauty of a large portion of the tract. The bulletin is an illustration of the method of the Bureau of examining private forest lands and extending expert advice in their management.

History of Austrian forestry, LASPEYRES (*Ztschr. Forst u. Jagdw., 37 (1905), Nos. 1, pp. 30–42; 2, pp. 113–124*).—In commemoration of the 50-years' reign of Francis Joseph, Emperor of Austria, a jubilee history of the development of agriculture and forestry in Austria for the years 1848 to 1898 was written. One of the 5 volumes deals with forestry. The extracts from this work given in this article relate to the development of the forest industry and its constitution, the use of the forest, sylviculture, forest management and protection, transportation of forest products, and forest engineering.

Investigations on the influence of kiln-drying at different temperatures on the percentage germination of pine seed, HAACK (*Ztschr. Forst u. Jagdw., 37 (1905), No. 5, pp. 296–312, dgms. 9*).—A report is given upon the results of an investigation upon the germinative ability of pine seeds gathered at different periods in the fall and kiln-dried at different degrees of temperature.

In these experiments seed gathered late in the fall germinated as well as seed gathered the following March. Seed gathered the middle of August had a whitish unripe appearance, was subject to mold, and gave a percentage germination of 80 to 92. A month later the seeds were more nearly ripe and gave a percentage germination of 90 to 98. It is believed that by the beginning of November of every year pine seeds have reached their full germinative ability.

Seeds mechanically removed from the cones early in the season without drying gave a higher percentage germination and germinated in half the time required for dry seeds. March-gathered seed, kiln-dried at a temperature of 65° C. 7½ hours, gave a percentage germination of 78 to 87. When kiln-dried at 61° C. for 2 hours and the temperature then gradually decreased to 55° C. for 9 hours the percentage germination was 94 to 97.

With the more sappy cones gathered in December kiln-drying at 65° C. decreased the percentage germination to 20 per cent. Even the seedlings that did grow when the seed was dried at this temperature presented a stunted appearance. It was determined that the maximum temperature at which these sappy fall cones may be kiln-dried is 60° C. for 2 to 3 hours, decreasing then to 55 to 56° C. The optimum temperature for such cones is placed at 49° C. Naked seeds were found able to withstand without injury to their germinative ability a much higher temperature and for a longer period than seeds in the cones.

The following general deductions are drawn by the author from the experiment: Pine seeds are very sensitive to a high degree of heat. Between the permissible and injurious temperatures lie so few degrees that extra care is necessary in kiln-drying these seeds. The greatest danger lies in kiln-drying moist cones. For this reason cones which remain longer on the tree and are, therefore, riper and drier are to be preferred for seed purposes, and not for the reason sometimes given that the seed in early-picked cones is less able to germinate.

Natural grafting, L. S. HOPKINS (*Amer. Inventor, 14 (1905), No. 2, p. 33, figs. 2*).—Illustrations and descriptions are given of two natural grafts between adjacent sycamore trees.

Thinning spruce, SCHWAPPACH (*Ztschr. Forst u. Jagdw., 37 (1905), No. 1, pp. 11–30*).—The right method of growing spruce has long been considered a settled question by German foresters. Observation in Austrian forests, however, where the use of small timbers necessitated the thinning of spruce much earlier than usual led to the discovery that from the standpoint of greater growth and larger profits early thinning, which gave opportunity to the remaining trees for better crown development, was very desirable.

The details of the investigation are recorded at considerable length, based upon which the following conclusions are drawn:

(1) By growing spruce in dense stands the crown is stunted and food elaboration therefore impaired. (2) The method of growing spruce close together in youth, and first thinning in middle age, does not use the site to the full capacity and results in a loss to the owner. (3) A stunted spruce crown regains its vigor very slowly and on poor sites not at all. Consequently late thinning exercises no considerable influence on the accretion.

(4) A rational treatment of spruce forests requires, therefore, avoidance of too close planting, say from 4,000 to 6,000 plants per hectare, and (5) the gradual decrease of this number through frequent thinnings as soon as the branches begin to die off to a height of 12 to 15 ft. (6) The aim in thinning must be the production of the greatest possible number of well-developed stems with crowns fully developed on all sides and the trees as equally distributed over the area as possible, constant attention being given to the breaking up of the groups. (7) The live portion of the crown should never average less than 30 per cent of the height of the tree.

The regulation of the spacing in planting and thinning spruce forests, MARTIN (*Ztschr. Forst u. Jagdw., 37 (1905), No. 7, pp. 419–427*).—The author briefly reviews the paper by Dr. Schwappach above and gives supplemental data along several lines drawn largely from German sources.

The data given do not show any stunting of the crown resulting from too close planting, and the author believes that no hard and fast rules as to spacing in planting and in thinning spruce can be formulated. From an economic standpoint thick planting where there is a considerable demand for small timber, as in Germany, may be of as great value as a less number of larger trees.

The effect of forest cover upon stream flow, W. B. GREELEY (*Forestry and Irrig., 11 (1905), Nos. 6, pp. 163–168; 7, pp. 309–315, figs. 4*).—A discussion of the general factors governing stream flow. In addition to the effects of forest cover, the varying influences of precipitation, topography of the drainage basin, and its geological character are discussed.

Investigations in connection with the Reclamation Service covering 3 years were made with reference to these factors in 2 tributaries of the Hudson, Esopus Creek, and Wallkill River. The catchment area of Esopus Creek has only about 15 per cent of cleared land on it. In the Wallkill Basin, on the other hand, about 85 per cent of the land is cleared. Precipitation and climatic conditions in the two basins are practically the same.

The grade of the slope of the Esopus Basin is 13.05 per cent or twice as steep, and the fall of the river is 59.6 ft. per mile, or about 6 times as rapid as that of the Wallkill. The topography of the basin is also much more simple and direct. There are no natural reservoirs in the Esopus Basin, while 42.52 sq. mi. or 5.04 per cent of the total area of the Wallkill Basin is occupied by lakes, ponds, or swamps.

The characteristic geological features of the Wallkill Basin are deep layers of fine loamy, marly soils of large absorptive capacity, while in the Esopus Basin there is only a thin layer of soil which tends to shed water immediately rather than to store it.

Studying the weekly deviation of these 2 streams from 1901 to 1903, inclusive, it was found that the percentage deviation from the average weekly mean flow was 78.24 per cent for the Wallkill and 83.69 per cent in the case of the Esopus. It is thus shown that the combined influence of moderate topography, natural reservoirs, and favorable geological conditions of the Wallkill are stronger in promoting evenness of stream flow than the compact forest of the Esopus. The difference, however, is small, the forest cover overcoming in a very large degree the unfavorable effects of steep topography, hard and dense surface rocks, and marked deficiency in natural storage facilities.

It is concluded, therefore, from the evidence in hand that temperature and precipitation being equal, the relative regularity of stream flow is determined first by the topographic and geological conditions, and second by the character and extent of forest cover.

Fire protection in the teak forests of Burma, R. S. Troup (*Indian Forester, 31 (1905), No. 3, pp. 138–146, dgms. 2*).—The author made a careful study of the growth and reproduction of teak on an area of 37 acres, which had had fire protection since 1872–73, and another area of 24 acres lying alongside, which had had no fire protection and which was burnt over annually.

From the data obtained it is shown that in moist, mixed, fire-protected forests the bamboo grows so rapidly as to depress and severely injure teak trees, while with annual burning the bamboo is suppressed sufficiently to permit of the very satisfactory growth of teak. The locality chosen for this experiment is believed to be typical of hundreds of square miles in Burma, and it is believed that fire protection over such areas is decidedly injurious to the development of teak.

In Vol. 31, No. 7, pp. 383–388, of the same publication, a number of discussions on the above paper appear, some of which confirm the author's views, and others point out that in the very dry teak forests of Burma, where the cover is much lighter, fire protection is of undoubted value in aiding the young teak plants to establish themselves.

Discovery of maniçoba rubber forests in Brazil, H. W. Furniss (*Mo. Consular Rpts.* [*U. S.*], *1904, No. 287, pp. 52–57*).—The author states that extensive forests of "maniçoba" or Ceará rubber (*Manihot glaziovii*) have recently been discovered in the interior of Brazil, particularly in Bahia.

Methods of maniçoba rubber culture are discussed, with an account of milk production and of extracting and collecting the latex. The quality of this rubber seems to be very high. It is believed that it could be profitably introduced into the southern part of the United States, and especially into Porto Rico and the Philippines. Statistics are given on the exports of the Bahia rubber to different countries of Europe and the United States during each of the years 1901 to 1904.

Rubber tapping in the botanic gardens, Singapore (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 5, pp. 144–154*).—Tabulated data are given which show the yields obtained from trees of different sizes tapped in the morning as compared with those tapped in the evening. There were 15 trees in each experiment and 5 experiments were made. The trees in the different experiments varied in circum-

ference from 3 to 7 ft. On the whole, the morning tappings gave about 10 per cent better results than evening tappings.

Terms used in forestry and logging (*U. S. Dept. Agr., Bur. Forestry Bul. 61, pp. 53, map 1*).—The various popular and technical terms used in forestry and logging are defined and in many instances their equivalents given in German and French. The work was prepared by the Bureau of Forestry in cooperation with the Society of American Foresters.

Forestry terms in French, English, and German, J. GERSCHEL (*Vocabulaire Forestier Français-Anglais-Allemand. Paris and Nancy: Berger-Levrault [1905], 4. ed., pp. 203; rev. in Rev. Eaux et Forêts, 44 (1905), No. 2, pp. 48, 49*).—Previous editions of this work have been in the German and French languages. In the present edition the work has been enlarged to include English forestry terms.

DISEASES OF PLANTS.

Minnesota plant diseases, E. M. FREEMAN (*St. Paul: The Pioneer Press, 1905, pp. XXIII+432, pl. 1, figs. 211*).—The author's chief aim in this book is to disseminate knowledge of the destructive parasites of useful plants, to assist all concerned with the cultivation of plants to a more intelligent and thorough understanding of the habits of these parasites, and to point out established methods of combating such diseases. The object of the work is educational rather than immediately practical, the author thinking the practical combating of diseases will follow a better conception of their cause and importance.

After describing fungi in general, chapters are devoted to their physiology, reproduction, etc., fungi as causes of disease, different kinds of fungi, diseases due to causes other than fungi, etc. The economics of prevention and cure are discussed, formulas for fungicides are given, and spraying apparatus described, after which specific diseases are described under the heading of diseases of timber and shade trees, field and forage crops, garden crops, orchards and vineyards, greenhouse and ornamental plants, and wild plants.

The author has unavoidably omitted some diseases, while others, although not yet observed in the State, are included on account of their importance. A number of plant diseases are also described which are economically of minor importance but which are illustrative of certain classes of diseases that otherwise could not be treated.

The author has drawn freely on experiment station literature for information regarding diseases and their prevention. The work is especially commendable on account of its appearance and the excellence of its illustrations, most of which are new.

A report on plant diseases of the State, J. L. SHELDON (*West Virginia Sta. Bul. 96, pp. 69–99, pls. 6*).—Popular descriptions are given of a number of diseases of cultivated plants, the information being based upon the author's investigations while traveling about the State and also upon a large number of replies to letters sent out asking for information relative to diseases. The arrangement is alphabetical by host plants.

Annual report of the literature of plant diseases for 1903, M. HOLLRUNG (*Jahresbericht über die Neuerungen und Leistungen auf dem Gebiete der Pflanzenkrankheiten. Berlin: Paul Parey, 1905, pp. VIII+374*).—A review is given of the literature relating to plant diseases and insect injury to plants for the year 1903, which includes references to more than 2,200 articles either by abstract or title. The arrangement of the material and method of treatment is similar to that in previous volumes (E. S. R., 14, p. 1091).

Notes on the Erysiphaceæ of Washington, W. H. LAWRENCE (*Jour. Mycol., 11 (1905), No. 77, pp. 106–108*).—A list is given of the species of powdery mildews col-

lected by the author in the State of Washington, with critical notes regarding the different species, the host plants, etc.

The Ustilagineæ, or smuts, of Connecticut, G. P. CLINTON (*Conn. State Geol. and Nat. Hist. Survey Bul. 5, pp. 45, pls. 7*).—A list of smuts known to occur in Connecticut is given, based chiefly on collections made by the writer during the past 3 seasons, which are contained in the herbarium of the Connecticut State Station. The list embraces descriptions of 12 genera and 50 species.

Cultures of Uredineæ in 1904, J. C. ARTHUR (*Jour. Mycol., 11 (1905), No. 76, pp. 50–67*).—The author gives a report upon investigations of plant rust which cover studies from 1899 to 1904. In these studies the grass and sedge rusts hold a prominent place, but a number of others have been included.

Successful cultures which have not hitherto been reported are given as follows: *Melampsora bigelowii* grown from teleutospores on *Salix amygdaloides* sown on *Larix decidua; Puccinia tomipara* from teleutospores on *Bromus ciliatus* sown on *Clematis virginiana; Puccinia stipæ* from teleutospores on *Stipa spartea* sown on *Aster multiflorus, A. ericoides*, and *A. novæ-angliæ; Puccinia sorghi* from æcidiospores on *Oxalis cymosa* sown on *Zea mays;* and *Puccinia podophylli* from æcidiospores on *Podophyllum peltatum* sown on same host.

The cedar apple fungi and apple rust in Iowa, L. H. PAMMEL (*Iowa Sta. Bul. 84, pp. 36, figs. 11*).—During the past few years apple rust has become so prevalent in Iowa that the author was led to investigate the subject and presents the results in this bulletin.

The relationship between the cedar apples caused by Gymnosporangium upon junipers, and the Rœstelia stage occurring on a number of rosaceous plants is described. Lists are given showing the connection between different species of Gymnosporangium and Rœstelia, after which the author describes at some length *G. globosum, G. macropus, G. clavipes, G. nidus-avis*, and *G. clavariæforme*. The distribution of these species is indicated and the relationship between the two forms pointed out.

A number of inoculation experiments made by the author and others are described, showing the results of the transfer of spores from the cedar apples to the leaves of different varieties of apples, to crab apples, service berry, etc. Decided differences are noted in the degree of susceptibility possessed by different varieties of apples, and for the control of the rusts the author recommends the planting of resistant varieties and the removal of the cedar trees about orchards.

Report of the mycologist, J. B. CARRUTHERS (*Admin. Rpts. Roy. Bot. Gard. Ceylon, 1904, Ed., Sci., and Art, pt. 4, pp. 5, 6*).—Notes are given on the gray blight of tea, caused by *Pestalozzia guepini*, the root disease of tea (*Rosellinia radiciperda*), and diseases of rubber, cacao, and betel pepper.

On the occurrence of Peronospora parasitica on cauliflower, H. VON SCHRENK (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 121–124, pls. 3*).—It is stated that cauliflower plants grown in a greenhouse in the Missouri Botanical Garden during 1903 were almost universally attacked by the mildew, *Peronospora parasitica*.

The fungus made its appearance suddenly, and within a week had affected practically every plant in the greenhouse and threatened the entire destruction of all cauliflowers. Acting upon various suggestions for the control of this fungus a number of sprays were used including copper sulphate, ammonium copper carbonate, and potassium sulphid. In order to make the solutions more adhesive small quantities of glue were added and it was found to form a very effective way of holding the solutions on the leaves of the cauliflower.

Good results were obtained with all the sprays with the exception of ammonium copper carbonate, which while killing the fungus caused other injuries to the leaf which are mentioned in another place. The fungus disappeared during the spring months, and the following winter the beds of the greenhouse were carefully treated

with lime. Since that time there has been no further attack upon the cauliflower in this house.

Intumescences formed as a result of chemical stimulation, H. VON SCHRENK (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 125–148, pls. 7*).—As mentioned in another place, while spraying cauliflowers for the crucifer mildew, *Peronospora parasitica*, with ammonium copper carbonate certain injuries were noted on the leaves. These were more abundant on the lower surface than on the upper, and consisted of various irregular swellings and distortions. The experiments carried on showed that similar intumescences were produced by means of weak solutions of other copper salts, and that they were entirely independent of the soil or atmospheric conditions.

They are considered a result of the stimulating activity of chemical poisons sprayed upon the leaf in weak solutions. This activity is probably due to the formation of compounds within the cells, either in combination with the copper salts or compounds which are a result of the stimulus observed by the spray. This is evidenced by the presence of large amounts of oxidizing enzyms as a result of extra stimulus exerted by the salts sprayed upon the leaf surface. A bibliography of 40 papers is appended to the report.

A disease of cauliflower and cabbage caused by Sclerotinia, G. G. HEDGCOCK (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 149–152, pls. 3, fig. 1*).—For several years a disease of cauliflower and cabbage has been observed at the Missouri Botanical Garden and in the vicinity, which is manifested by a dark rot of the plants accompanied by numerous tiny black specks.

The disease was at first thought to be a form of the bacterial rot, but a more careful examination showed that the interior of the cauliflower stems was uniformly filled with mycelium of the fungus which was identified as *Sclerotinia libertiana*. The rot produced by this fungus is more watery and the diseased tissues are not so dark as in the case of the bacterial rot of cruciferous plants.

Inoculation with the ascospores from the apothecia and the mycelium from pure cultures produced the typical rot of the cauliflower. Control plants, wounded but not inoculated at the same time, remained free from the disease.

A disease of cultivated agaves, G. G. HEDGCOCK (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 153–156, pls. 3*).—A number of small plants of *Agave utahensis* were potted during the spring of 1904 and placed in the large collection of the Missouri Botanical Garden. In a short time many of the plants were found dying from a disease which first attacked the older leaves.

A study of the fungus showed that it belonged to the species Colletotrichum and inoculation experiments showed that it could be readily transferred. The disease has a striking appearance, the tissues penetrated by the mycelium showing either a circular or elliptical spot which at first is dark in color, changing as the tissues die, to brown or gray. Under humid conditions the leaves turn brown and rot rapidly.

Bordeaux mixture of the ordinary formula proved beneficial in preventing the spread of the fungus to adjacent plants.

Fungus galls, H. VON GUTTENBERG (*Beiträge zur physiologischen Anatomie der Pilzgallen. Leipsic: Wilhelm Engelmann, 1905, pp. 70, pls. 4; rev. in Nature [London], 72 (1905), No. 1867, pp. 339, 340*).—In this work the author describes the effects caused by 5 different fungi on as many host plants.

Both fungi and hosts belong to widely separate families and include Albugo on shepherd's purse, Exoascus on alders, Ustilago on maize, Puccinia on Adoxa, and Exobasidium on Rhododendron. The author attempts to explain the various anatomical changes occurring in the fungus galls from a physiological standpoint. These changes, in his opinion, are mostly due to a change of function which the tissues assume under the influence of the parasite for its exclusive benefit.

In the main, the author considers the fungus as controlling the development of the host plant, but in the case of the corn smut it is shown that where the intracellular

hyphæ pass through cells they become inclosed in a cellulose tube which may subsequently become more or less thickened. The changes produced in the nuclei of hosts, the development of haustoria, etc., are described, and on the whole the work treats of the subject from a somewhat new point of view.

Ripe rot, or anthracnose, of banana (*Agr. News [Barbados], 4 (1905), No. 83, p. 189*).—A brief note is given on a ripe rot or anthracnose of bananas, an account of which has been previously presented (E. S. R., 15, p. 486).

Thrips and black blight, H. A. BALLOU (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1904, No. 44, pp. 132-135*).—A report is given of investigations carried on by the author on the thrips of cacao and the black blight.

The thrips (*Physopus rubrocinctus*) has been known in Grenada for a number of years, and where present in abundance is associated with the black blight. This blight is due to the fungus Capnodium, which finds its most favorable conditions for growth in the secretions of scale insects. A list of trees is given upon which the black blight was conspicuous, among them being the mango, breadfruit, sapodilla, guava, limes, and oranges.

No serious attack of black blight has been observed on cacao or nutmeg, and it is believed that until scale insects attack these plants the black blight will not. The control of the fungus is a rather simple affair, and consists of spraying to destroy the various scale insects.

Pod diseases of cacao (*Agr. News [Barbados], 4 (1905), No. 83, p. 189*).—There are said to be 3 pod diseases of cacao, only 2 of which are of serious importance in the West Indies. These are the Trinidad pod disease, caused by the fungus *Phytophthora omnivora* and the brown rot due to *Diplodia cacaoicola*. Both of these diseases are described, and precautionary measures of burning or burying the pods are recommended.

Witch broom disease of cacao (*Agr. News [Barbados], 4 (1905), No. 78, p. 105*).—This disease, which has been considered a very destructive one, the author claims is a consequence of poor development of trees, the roots frequently being set in ground that is perfectly saturated with water for several months at a time. The result of planting in such a situation is a weak growth, making the trees particularly susceptible to fungus attack. It is also observed that trees that are more than 35 years old are also subject to the fungus by reason of their impaired vitality.

Disease in immortelles (*Bot. Dept. [Trinidad], Bul. Misc. Inform., 1904, No. 44, p. 148*).—For some time complaint has been made that cacao shade trees were dying in certain regions, the tree most affected being the immortelle, *Erythrina umbrosa*.

Diseased specimens which were examined showed the presence of abundant fungi, but as yet the character of the fungus has not been determined. The investigations seemed to show that this species of tree is poorly suited to the soil and situation where the disease has appeared, and probably some other shade tree should be substituted for it.

A disease of black oaks caused by Polyporus obtusus, P. SPAULDING (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 109-116, pls. 7, map 1*).—A disease caused by the fungus *Polyporus obtusus*, which was quite destructive locally to several species of oak trees, is described.

The fungus seems to be confined to North America and its distribution is indicated. So far as known it occurs only on species of oak belonging to the black oak series, and seems to be associated with the attacks of an oak-boring insect which is believed to be *Prionoxystus robiniæ*. The spores of the fungus are apparently blown into the entrances of the burrows, where they germinate and the fungus grows following the burrow until the heart of the tree is reached. Here the heartwood becomes affected, and the rot extends through the wood of the trunk until the top is broken by the wind or the weight of the tree.

All gradations in the severity of the disease are found, and as it progresses in the heartwood the sapwood becomes affected and is no longer able to carry on its proper functions in relation to the tree. Ordinarily the heartwood of these trees is naturally dark in color, but when affected by the fungus it turns a light yellowish tint and in the last stages becomes nearly white. It retains its fibrous appearance but breaks much easier than does the healthy wood. No suggestion is given for the control of the fungus.

Willow canker, T. JOHNSON (*Sci. Proc. Roy. Dublin Soc., n. ser., 10 (1904), II, pp. 153–166, pls. 3*).—The author reports having observed in the autumn of 1899, in specimens of willows sent for examination, black spots which rendered the osiers useless for basket making.

These spots, which have a canker-like appearance, are easily recognized externally and may reach through the shoots to the pith. They cause weakening of the stems, which break at the least attempt to bend them. A study of the fungus showed that the disease was caused by *Physalospora gregaria* and associated with it were the two other stages which are distinguished as *Tetradia salicicola* and *Macrodendrophoma salicicola*.

Judging from analogy the author believes that all 3 fruiting stages are capable of infecting healthy willows. Poor undrained bogs and a prevalence of weeds would favor development, and every care should be taken not to plant diseased sets from an infected holt. Land chosen for osier growth should be well drained and if bog land should be treated with lime, potash, and phosphoric acid. If the disease appears, all attacked sets should be dug out and burned. A weak solution of formalin, 0.5 per cent, it is believed would be useful as a spray to keep the fungus from spreading.

Glassy fir, H. VON SCHRENK (*Mo. Bot. Gard. Ann. Rpt., 16 (1905), pp. 117–120, pls. 2*).—A description is given of specimens of balsam fir which were received during the winter at the laboratory, and which exhibited peculiar smooth spots at various points in cross sections.

Some of these areas extended from the heart to the sapwood, while others formed irregular circumscribed spots. A great deal of balsam fir is used for pulp wood in the region from which these specimens were obtained, and it was claimed that this appearance indicated a defect in the wood. Investigations showed that this appearance is quite frequent during winter months, and it is suggested that it is due to freezing.

To secure experimental evidence to corroborate this belief, the author saturated a number of specimens of loblolly pine, after which they were subjected to temperatures below zero and partially sawed through when in a frozen condition. After thawing, the pieces were cut completely in two for examination, and the portions that had been cut while in the frozen condition exhibited a condition analogous to that mentioned in the fir. It is believed that this defect is due to freezing and cutting when there is a superabundance of water in the trunk of the tree.

Corticium chrysanthemi, C. B. PLOWRIGHT (*Brit. Mycol. Soc. Trans. 1904, pp. 90, 91, pl. 1*).—The author reports having noticed a number of years ago chrysanthemums planted for permanent ornamentals which had died off, and in each case a white fungus growth was present on the lower part of the stems. Recently his attention has been called to this same trouble, and a careful examination was made to ascertain the cause of the disease.

The stems show a white hymenium on the living and dead stems at the level of the ground, matting the earth and the shoots together so that the gardener may at once recognize the trouble he has to deal with. The only treatment seems to be the burning of the diseased plants and the use of only healthy cuttings. A technical description of the fungus is given.

Concerning the root rot of cotton.—In the note on the root rot of cotton by V. Mosseri (E. S. R., 17, p. 45) an error was committed in stating that the disease in

Egypt differed from that known in this country. The author in the course of his paper shows them to be identical, but calls attention to the fact that the fungus known in the United States as *Ozonium auricomum* is not the same as that species found in Europe. In discussing treatment the general possibilities of securing immune strains through selection are pointed out and a variety of bananas immune to root knot is described. The banana is not subject to root rot.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The international code of zoological nomenclature as applied to medicine, C. W. Stiles (*Pub. Health and Mar. Hosp. Serv. U. S., Hyg. Lab. Bul. 24, pp. 50*).—The international code is taken up seriatim, and each article is discussed and recommendations given. A detailed synonymy is presented for *Tænia solium, T. saginata, Dipylidium caninum, Dibothriocephalus latus,* and *Echinococcus granulosus.*

Report of the entomologist, J. B. Smith (*New Jersey Stas. Rpt. 1904, pp. 557–652, pls. 10, figs. 4*).—San José scale was unusually abundant during the season and caused great damage. Notes are given on the prevalence of *Pseudococcus aceris,* elm-leaf beetle, cabbage worms, onion maggot, potato beetle, bollworm, strawberry weevil, etc. Insecticide treatment of cottony maple scale is rather unsatisfactory. Summer applications of soap and kerosene and winter washes are partly effective.

The second brood of codling moth should be combated with bands, but the banding method should be combined with spraying, destruction of infested fruit, and all other known precautions. Cranberry insects are also briefly noted.

A detailed account is given of attempts to introduce the Asiatic ladybird into New Jersey and other localities. Only a portion of the beetles survive the winter even in Georgia. The beetle is apparently unable to keep the San José scale in check. Notes are presented on *Tenodera sinensis* as a predaceous insect.

A test was made of potassium sulphid, sulphite of soda, and Con-Sol for destroying San José scale on peach trees. Potassium sulphid and lime proved most effective. This remedy seems not to injure peach foliage when applied in summer and kills the scale insects. Sulphite of soda was of no avail, and Con-Sol was comparatively ineffective.

Lime-sulphur wash was almost a complete failure in New Jersey during the winter of 1903–4 as used by fruit growers. A study was made to determine the causes of failure, and various recommendations are made regarding the composition and preparation of the wash. Caustic soda was thoroughly tested as an insecticide and the results were not encouraging. Salimene and Universal insecticide and scale killer also proved to be of little or no value. Crude oil and kerosene continue to give good results. Kill-O-Scale is quite effective but too expensive. Pyrol tree and plant spray neither killed the scale nor injured the foliage. Horticultural Compound proved effective against plant lice but not against San José scale. Rose-leaf tobacco extract gave fairly good results as a remedy for grape-leaf hoppers and scale insects.

Third annual report of the chief inspector (*Ohio Dept. Agr., Div. Nursery and Orchard Inspection Rpt. 1904, pp. 34*).—During the year 1904 the inspector carried on the usual work of his office in the control of harmful pests in nurseries and orchards. Nurseries were inspected, fumigation was carried out on a large scale in houses built for that purpose, and orchard inspection was undertaken wherever it appeared to be necessary. During the year serious injuries were suffered from cankerworm, San José scale, elm-leaf beetle, grape-blossom bud-gnat, and other insects. A copy is given of the nursery and orchard inspection law of the State.

The arrowroot worm (*Agr. News [Barbados], 4 (1905), No. 76, p. 74*).—*Calpodes ethlius* is said to cause serious damage to arrowroot, cannas, and related plants. The use of Paris green and London purple appears to give the best results. Certain birds, including the common blackbirds of the Barbados, feed upon these pests.

FOODS—HUMAN NUTRITION.

The milling and chemical value of the grades of wheat in the Manitoba Inspection Division, crop of 1904, C. E. SAUNDERS and F. T. SHUTT (*Canada Cent. Expt. Farm Bul. 50, pp. 20*).—Studies are reported on the character and milling qualities of a number of varieties of Manitoba wheats.

The milling value of the grades of wheat, C. E. Saunders (pp. 5–12).—The 7 samples of high and low grade wheats, 2 of feed wheats, and 1 of frosted wheat included in the investigation, it is believed represent fairly the grades shipped from Fort William, Manitoba.

The results of the milling tests showed that the amounts of straight-grade flour and total flour decreased from the higher to the lower grades of wheat, while the amounts of low-grade flour and of shorts and bran increased. The changes were fairly regular, though the differences between any 2 grades were more noticeable as the lowest grade was approached.

The large proportion of low-grade flour obtained from the poorest samples of wheat is, in the author's opinion, a clear indication of their inferior character. The straight flours from the different grades of wheat were much alike in color when dry, though that from the lower grades was less creamy and of a grayish tint. In the author's opinion all the flours tested, except those ground from the feed wheat, were suitable for bread making.

As regards the price of wheat, "it is evident that what may be called the single milling value of the different grades can never fix the prices that will be paid for the wheat. The highest grades will probably always command enhanced prices, while the value of the lowest grades will be determined by their utility for feeding purposes and not for milling. For some of the intermediate grades it seems possible that millers could afford to pay relatively higher prices than those which have lately prevailed if greater attention were given to the grinding of such wheat and special efforts made to find the most advantageous markets for the products."

A chemical study of the grain and flour of the grades of wheat, F. T. Shutt (pp. 13–20).—Analyses of the different grades of wheat included in the investigations noted above and of the flours ground from them are reported, and the composition discussed in relation to the relative value of the different wheats.

"We find a great similarity in composition between these wheats, especially among the higher members of the series, as regards all the more important constituents, i. e., those which affect the bread-making quality, and we should presurmise, therefore, that the grading has been based upon the relative yield of first quality flour (of which color is an important factor) rather than upon the essential differences in what might be termed the relative strengths of the wheats.

"As regards quantity of flour, we have shown that in such a series the weight of the kernel and the weight per bushel, and to a minor degree the fiber, indicate the relative flour yield. Our results in these determinations are in excellent accord, supporting the supposition that the grading of the wheats has been made primarily from the standpoint of yield of first quality flour.

"The percentage of protein in the wheat undoubtedly is a measure of the strength of the resultant flour, but if we except . . . [a sample of feed wheat and one of frosted wheat] we scarcely think it would be justifiable to use differences in protein content such as we have met with between these wheats (frequently less than 0.25 per cent) as a basis for the arrangement of the wheats in their order of merit. And the same holds true for the data regarding gluten and gliadin. It is highly significant, therefore, that the resultant flours were found so uniform in quality for bread making."

Dietetics in relation to hospitals for the insane, W. O. ATWATER (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 473-492*).—Investigations noted from a previous publication (E. S. R., 16, p. 688) are summarized and general problems connected with institution dietetics are discussed, particularly hospitals for the insane.

Labels on adulterated and imitation foods, R. M. ALLEN (*Kentucky Sta. Bul. 119, pp. 23-41*).—The State pure-food law, which has been in operation 6 years, requires that food shall be so labeled that its true character may be known.

Such publicity, according to the author, has "about stopped the use of formaldehyde in milk and boric acid in meat. It is stopping the use of aniline dyes in fruit products and saccharin in canned corn. It is stopping the use of salicylic and benzoic acids in jellies, preserves, ciders, and grape juices. Imitation products are being labeled for what they are, and if the consumers will purchase with ordinary care they can protect health and obtain fair values in the purchase of foods."

In many instances the labels are not as plain as they should be, and the information which the law demands shall be made public is printed in such a way that it is not likely to be read or is expressed in terms with which the public is not familiar. Some of the terms used are explained, and sample labels are reproduced so that labels of this character may be understood. The bulletin also contains a discussion of antiseptics and coloring matter.

The protective value of proteids and their decomposition products on trypsin, H. M. VERNON (*Jour. Physiol., 31 (1904), No. 5, pp. 346-358*).—The following statements are quoted from the author's summary of his investigations:

"The protective value of various substances upon trypsin was estimated by keeping pancreatic extract with 0.4 per cent sodium carbonate and a known percentage of the substance for 1 hour at 38° C., and determining the amount of trypsin thereby destroyed. As a rule the protective value depends almost entirely upon the power the substance possesses of neutralizing the alkali, and so rendering it incapable of reacting upon the ferment.

"Most proteids have practically the same protective value, about 45 per cent of the trypsin of an extract being destroyed per hour in presence of 0.4 per cent of proteid, 27 per cent in presence of 1 per cent, 12 per cent in presence of 2 per cent, and 7 per cent in presence of 4 per cent of proteid. When no proteid was present 56 per cent of the ferment was destroyed. Hydrated proteids have a slightly greater protective value than native proteids, and the decomposition products of proteid hydrolysis a slightly greater one still. . . .

"In certain cases there is a combination between ferment molecule and proteid. Thus egg albumen possesses a most marked antitryptic action, the digestive power of the ferment being reduced to 29 and 2.9 per cent of its normal value in the presence of 0.05 and 1 per cent of the proteid, respectively."

ANIMAL PRODUCTION.

Relative values of feeding stuffs, H. P. ARMSBY (*Pennsylvania Sta. Bul. 71, pp. 16*).—Feeding stuffs have commonly been compared on the basis of digestible nutrients and on the basis of energy values. The author does not believe that such values are satisfactory, but is of the opinion that the work required to eat and assimilate, which is known to vary with different feeding stuffs, should also be taken into account.

With the respiration calorimeter for experiments with animals (E. S. R., 15, p. 1036) such factors can be studied, and the bulletin summarizes the results of experiments with steers made to compare timothy hay, clover hay, and corn meal, both for maintenance rations and for production. The following table shows the absolute and relative values of these feeding stuffs as computed on the basis of digestible

nutrients and fuel value, and also the maintenance value and production value on the basis of the results obtained with the respiration calorimeter:

Fuel values, maintenance values, and production values per pound of several feeding stuffs.

	Computed from digestible nutrients.	Actual fuel value.	Maintenance value.	Production value.
	Calories.	*Calories.*	*Calories.*	*Calories.*
Absolute values:				
Timothy hay	875	777	489	259
Clover hay	901	742	270	....
Corn meal	1,525	1,308	1,016	697
Relative values:				
Timothy hay	1.00	1.00	1.00	1.00
Clover hay	1.03	0.96	0.56	....
Corn meal	1.74	1.68	2.11	2.73

As will be noticed, both the production and maintenance values are decidedly lower than the values computed from digestible nutrients or from fuel value.

"Coarse fodders in particular were found to have much lower values, for maintenance as well as for fattening, than concentrated feeds, the relative values of the former as compared with the latter being greatly overestimated in the feeding tables in common use."

The author calls attention to the fact that the results at present available are not numerous and therefore that deductions are suggestive rather than final.

"On the other hand, however, it is believed that the distinctions which . . . [the figure obtained] show between the digestible nutrients, the fuel values, the maintenance values, and the production values, as well as the differences between different classes of feeding stuffs, in these respects are significant. In other words, it is believed that the differences are too great to be explained by experimental errors.

"When we find, for example, that on the basis of digestible nutrients 174 pounds of timothy hay are the equivalent of 100 pounds of corn meal, while the actual experiment on the animal shows that for maintenance 211 pounds and for fattening 273 pounds of timothy hay are required to equal 100 pounds of corn meal, we are dealing with differences too large to be accidental and too important to be ignored in the practical computation of rations.

"Furthermore, these results show that the only safe basis for a comparison of the values of feeding stuffs is the actual experiment upon the animal, in which the real gain or loss of flesh and fat is accurately determined. In other words, the only way to ascertain the nutritive effect is to actually determine it."

On the basis of available data, the production value per 100 pounds has been computed for a number of the common American feeding stuffs. Some of these values are as follows:

Production values per 100 pounds of a number of feeding stuffs.

Feeding stuff.	Total dry matter.	Total crude fiber.	Digestible. Proteids.	Digestible. Carbohydrates.	Digestible. Fat.	Production value.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Calories.*
Green fodder and silage:						
Alfalfa	28.20	7.40	2.50	11.20	0.41	10,806
Clover, red	29.20	8.10	2.21	14.82	0.69	14,528
Corn fodder	20.70	5.00	0.41	12.08	0.37	11,024
Corn silage	25.60	5.80	1.21	14.56	0.88	14,260
Timothy	38.40	11.80	1.04	21.22	0.64	17,809
Hays:						
Alfalfa	91.60	25.00	6.93	37.33	1.38	34,413
Clover, red	84.70	24.80	5.41	38.15	1.81	34,748
Soy-bean	88.70	22.30	7.68	38.72	1.54	38,656
Timothy	86.80	29.60	2.05	43.72	1.43	33,562

Production values per 100 pounds of a number of feeding stuffs—Continued.

Feeding stuff.	Total dry matter.	Total crude fiber.	Digestible. Proteids.	Digestible. Carbohydrates.	Digestible. Fat.	Production value.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Calories.*
Straws:						
Oat	90.8	37.0	1.09	38.64	0.76	21,213
Rye	92.9	38.9	0.63	40.58	0.38	20,876
Roots, etc.:						
Carrots	11.40	1.30	0.37	7.83	0.22	7,829
Potatoes	21.10	0.60	0.45	16.43		18,054
Grains:						
Barley	89.1	2.7	8.37	64.83	1.60	80,758
Corn	89.1	2.1	6.63	66.12	4.97	88,847
Oats	89.0	9.5	8.36	48.34	4.18	66,279
Rye	88.4	1.7	8.12	69.73	1.36	81,721
Wheat	89.5	1.8	8.90	69.21	1.68	82,636
By-products:						
Cotton-seed meal	91.8	5.6	35.15	16.52	12.58	84,206
Gluten Feed, dry	91.9	6.4	16.09	54.22	5.35	79,422
Linseed Meal, new process	90.1	8.8	29.26	38.72	2.90	74,677
Wheat Bran	88.5	9.0	10.21	41.23	2.87	48,233

In connection with the data summarized, protein requirements and other factors are briefly considered.

Second report on feeding-stuff inspection, B. W. Kilgore, C. D. Harris, J. M. Pickel, and W. M. Allen (*Bul. N. C. Bd. Agr., 25 (1904), No. 11, pp. 67, figs. 15*).—The State feeding-stuff law is quoted and analyses, both chemical and microscopical, carried out under its provisions, are reported of 500 samples of wheat bran, middlings, ship stuff, corn and oat feed; rice, peanut, and saccharin feeds; gluten meal and feeds, chops, distillers' grains, hominy meal or feeds, corn-and-cob feeds, linseed meal, cotton-seed feeds, cotton-seed meal, dried beet pulp, mixed and mill feeds, mill sweepings, soy beans, wheat screenings, cane seed and corn feed, starch meal, graham wheat, stock feed, oats (whole and ground), meal and bran, and flour.

Some of the conclusions drawn regarding the extent of adulteration of some of the feeding stuffs follow: In the case of wheat bran 75 per cent of the samples examined were not up to the standard as regards protein content. The 20 samples of rice feeds examined were all found to be up to the standard. The peanut feeds included a feed for chickens, a feed for pigs, screenings, meal, middlings, and bran. Peanut meal, middlings, and bran, though differing in name, were all found to be made up of ground peanut hulls. Of the 84 samples of cotton-seed meal examined, 18 were below the legal standard.

The examinations which have been made, the authors state, show that the following adulterants are used to a considerable extent in making up the stock feeds sold in North Carolina: Corn, bran, rice chaff, ground corncobs, peanut hulls and middlings, oat hulls and dust, mill sweepings, screenings, cotton-seed hulls, and similar products. The composition of these materials is spoken of with the object of calling attention to their low nutritive value.

Investigation regarding succulence, F. W. Robison (*Michigan Sta. Spec. Bul. 32, pp. 15*).—Believing that the amount of energy required to assimilate feeds should be taken into account in determining their true feeding value, and that the proportion of succulent material would have an important bearing on this question, two series of experiments were undertaken with cows in which the digestibility of protein was determined on the basis of nitrogen in fresh feces, nitrogen in dried feces, and feces corrected for the proportion of metabolic products present. Foods, urine, and feces were analyzed, and the balance of income and outgo of nitrogen also determined.

In estimating metabolic products in feces, the ether, alcohol, water, and limewater method was employed. In periods 1 and 4 of the first series of tests, the food con-

sisted of a basal ration of clover, hay, oats, straw, bran and corn and cob meal, the nutritive ratio being 1 : 12.2. In the second period, wet sugar beet pulp was introduced into the ration, the basal ration being so changed that the dry matter of the total ration and the nutritive ratio remained constant. In the third period, the basal ration remained the same as before while the amount of sugar beet pulp was increased, the cows receiving all they would consume. In the second series of tests the conditions were the same except that in the fourth period dry sugar beet pulp was used in place of wet pulp, the dry matter and nutritive ratio of the ration being kept the same as in periods 1 and 2.

The coefficients of digestibility were in general lowest when the analytical data based on the fresh feces were taken into account, and highest when the corrections for metabolic products were introduced, but in no case were constant differences observed which could be attributed to the rations fed. The loss of nitrogen when the feces were dried ranged from .3 to 9.5 per cent and the amount of metabolic nitrogen of feces from 8.6 to 15.4 per cent, the variations being apparently caused by individual peculiarity or other conditions not determined. As regards the balance of income and outgo of nitrogen, the results varied from a loss of 4.4 grams per day with one of the cows fed a basal ration in the first series of tests to a gain of 12.1 grams per day with one of the cows fed the sugar beet pulp ad libitum.

"It is very noticeable that foods are utilized differently by different individuals. Two cows, although both are healthy and normal in every respect, will not utilize the same amount of nutrients in a given feed.

"In the first experiment both cows showed a slight increase in digestibility when beet pulp wet was added to the ration. In the second experiment one cow gave a slight increase, while the other showed practically no change. These figures are, however, so slight when an average is taken that they can not be said to prove an increase of digestibility due to the succulent feed.

"In all of the experiments a consideration of digestibility based on the nitrogen as found in the feces before drying, shows that former figures of digestibility of succulent feeds are given at least 5 per cent too high. Different feeds show varying percentages of volatile nitrogen in the feces, and inasmuch as it appears with the undigested food it should be taken into consideration, else our coefficients of digestibility are considerably too high. . . .

"Whatever the effect of succulence on the apparent digestibility of a food, which in these instances seems to be practically nil, it seems quite positive that a succulent food is digested at less expense than a dry food. In this way a succulent food should work antagonistic to a food rich in fiber and in the same capacity as grain. If an increase of cell oxidation is accompanied by an increase of metabolic nitrogen in the feces . . . then surely the expenditure of energy on a food high in factors of succulence is less than on a dry food. The above being true, it follows that the net available energy, other factors being equal, is greater in a succulent food than in a dry one."

The utilization of beet leaves, D. MEYER (*Fühling's Landw. Ztg., 54 (1905), Nos. 3, pp. 91–95; 4, pp. 145–152*).—The superior value of ensiled and dried beet leaves as compared with the green material is pointed out. According to the author, the dried leaves are generally considered the most satisfactory, though he believes that ensiling should receive more attention. Experimental data which have to do with the subject are summarized and discussed.

Mixed farming, R. W. PEACOCK (*Agr. Gaz. N. S. Wales, 16 (1905), No. 4, pp. 335, 336*).—Brief notes are given regarding the crops raised and the stock kept at the Bathurst Experimental Farm.

Especial attention is directed to providing a succession of grazing crops for sheep. "For winter feeding, rape, black tares, and early-sown wheats are principally to be relied upon. For spring feeding, rape, crimson clover, tares, prairie grass, and

sheep's burnet are valuable. For summer and autumn feeding, lucern, cowpeas, and stubble paddocks furnish the bulk of the food. By such practice it is possible to keep the ewes and lambs in good condition, and also allows of the lambs being marketed at profitable prices."

Feeding farm animals, T. BUTLER and B. W. KILGORE (*Bul. N. C. Bd. Agr., 25 (1904), No. 11, Sup., pp. 36*).—The composition and digestibility of feeding stuffs and related questions are discussed with special reference to the feeding of farm animals under local conditions.

To simplify the calculation of rations a table is given showing the amount of digestible nutrients furnished by different quantities of a number of feeding stuffs. Feeding standards are quoted, and rations suggested which meet the requirements of the standards. For a horse at light work a ration of 12 lbs. corn fodder, 2 lbs. cowpea hay, 5 lbs. corn, and 1 lb. cotton-seed meal is suggested, and for severe work 10 lbs. corn fodder, 5 lbs. cowpea hay, 10 lbs. corn, 2 lbs. cotton-seed meal.

"The horse is not able to digest coarse dry foods to the best advantage, and, moreover, large quantities of hay are objectionable where the horse is to do severe or fast work, because an overfull stomach interferes with respiration, which must be increased as the work is increased. In the opinion of the writer, therefore, both the rations for horses, given above, would be improved by slightly decreasing the hay and increasing the grain.

"Any difficulty experienced in getting a horse to eat the cotton-seed meal, when he has not been accustomed to doing so, may usually be overcome by grinding the corn and mixing the corn meal and cotton-seed meal. Cotton-seed meal is used in these rations to supply the necessary protein to repair the worn-out muscles instead of increasing the pea-vine hay for the reason given above and because any of the leguminous hays seems to cause too great a looseness in the bowels of hard-working horses. It is used in preference to oats and wheat bran because it is much cheaper."

For milch cows the authors believe that 5 lbs. of cowpea hay can replace 4 lbs. of wheat bran, since locally the wheat bran is expensive. As regards pig feeding it is stated that, "when a field of cowpeas, alfalfa, or peanuts is not available it will probably pay to balance the corn ration with wheat middlings or dried blood if either can be purchased at a reasonable price, unless some other protein food is available or the fattening period is to be an extremely short one."

Present methods of beef production, V, H. W. MUMFORD and L. D. HALL (*Illinois Sta. Circ. 94, pp. 4*).—The principal deductions which were drawn from replies to a list of questions sent to a number of Illinois cattle feeders regarding the breeding of beef cattle for market are as follows:

Only 12 per cent of the cattlemen represented raise all the cattle they fatten and but 35 per cent raise a part and buy the remainder. "With reference to the cattle involved, only 16 per cent are marketed by men who raise all the cattle they sell and 18 per cent by those who raise part and buy part of their cattle." Pure-bred sires were kept by 87 per cent of the correspondents who it is stated raise their own cattle, while the remainder report the use of grade bulls. Pure-bred cows were kept by 19 per cent of the cattle raisers and grades by 35 per cent, while 46 per cent did not state whether pure-breds or grades were used.

Forty-two per cent of the replies state that heifers are bred to produce market stock at 24 months. A number preferred 1 to 2 years and a very few more than 2 years. "The spring season is chosen by four-fifths of the correspondents as a time for the dropping of the principal crop of calves. The remainder are divided in their preferences among the summer, winter, and fall seasons, and but 2 per cent plan to have the calves dropped at 2 seasons, spring and fall.

"One-fifth of those who reply castrate calves when less than 1 week old; one-half castrate before the calves are over 1 month old; four-fifths castrate when less than 3 months old. Only 5 per cent of the correspondents delay the operation later than 6

months of age. . . . The length of suckling period recommended for calves intended for baby beef varies from 1 week to 10 months. Three-fourths of all the replies, however, recommend periods from 5 to 7 months in length. . . .

"A summary of the replies concerning the length of suckling period for calves not intended for baby beef shows that approximately three-fourths of all the replies name periods from 5 to 7 months in length." Of the concentrated feeds for the production of baby beef, corn was placed first in nearly half of the replies and oats in one-third, with bran, oil meal, corn and oat meal, barley, cotton-seed meal, gluten meal, wheat, and rye ranking next in the order named.

The comparison of the data relating to the feeding of calves and yearlings indicates that "concentrated feeds are generally regarded as most important in the feeding of calves, while for yearlings roughages seem to be considered of most consequence. . . . Corn is more highly regarded for yearlings than for calves, while the reverse is true of oats. The grinding of corn, however, appears to be considered more necessary in the case of yearlings. Clover hay is ranked much more highly for calves while for yearlings straw, varieties of hay other than clover, and corn-stalk fields are mentioned more prominently."

In general, the information gathered indicated that feeding beef cattle for market is a minor factor in Illinois cattle-feeding operations. (For earlier work see E. S. R., 16, pp. 805, 1112.)

The making of Prime Scots beef (*Breeder's Gaz., 47 (1905), No. 18, pp. 861–863, figs. 4*).—A descriptive article regarding the breeding and feeding for market of the best grade of beef cattle produced in Great Britain and known as "Prime Scots." The animals are marketed when 1 or 2 years old; are pastured in summer and fed during the winter on straw and roots. In many cases cake or grain is given for 3 months before marketing and at all times the animals are fed with great care.

Comparison of methods of preparing corn and clover hay for fattening steers, H. W. Mumford (*Illinois Sta. Bul. 103, pp. 43–93, figs. 11*).—This experiment was made to compare the economy of feeding corn on the ear, in the shock, shelled, and ground as corn meal and as corn-and-cob meal, and the advantages of chaffing clover hay. The economy of supplementing corn with nitrogenous feeds like gluten meal and linseed meal, when an abundance of clover hay is fed, was also studied. Corn silage formed a part of the coarse fodder of one lot.

One hundred and thirty 2-year-old steers were used, which were divided into 10 lots; and each lot was followed by pigs. The steers were fed in open sheds, the yards adjoining being paved with brick except in the case of one lot.

After a week's preliminary feeding the test began November 28 and continued for 186 days. Until full feed was reached in the fifth month the amount of corn supplied per day was gradually increased. The maximum amount fed was not far from one-third of a bushel per head per day. The nitrogenous feed consisted of gluten meal in the first half of the experiment and linseed meal in the last half, the change being made for the sake of variety. To the lots receiving this supplement it was fed in about the proportion of 10 lbs. per bushel of corn, the greatest amount being given to the lots receiving the corn-and-cob meal.

The largest gain, 2.45 lbs. per steer per day, was noted with the lot fed corn-and-cob meal, nitrogenous grain feed, and chaffed hay. Nearly as large gains (2.32 to 2.38 lbs.) were made by the lots fed unchaffed hay and the nitrogenous feed with corn-and-cob meal, corn meal, or ear corn. Considering all the lots the average daily gain was 2.25 lbs. per steer per day. The dry matter required per pound of gain ranged from 10.35 lbs. with the lot fed silage and corn meal to 13.42 lbs. with the lot fed shocked corn and ear corn.

The cost of a pound of gain ranged from 5.9 cts. with the lot fed ear corn without the addition of nitrogenous concentrates to 7.9 cts. with the lot fed corn meal and

chaffed hay. "The cheapest gain was made where the labor element in preparing the feed was reduced to the minimum." Data regarding shrinkage in dressing and the weight of hide, percentage of fat, etc., were recorded in connection with the slaughter test made at the close of the trial.

The greatest gain of the pigs, 1,115 lbs., was made by 7 pigs following the 10 steers fed shelled corn in the paved yard. The smallest gain, 63 lbs., was made by the pig following the 10 steers fed silage and corn meal.

Some of the author's conclusions were, in effect, as follows: Corn silage ranks with ear corn, corn meal, and corn-and-cob meal in its ability to make rapid gains on fattening cattle. Corn meal and corn-and-cob meal appear to be about equally efficient in producing quick finish. More rapid gains were secured in this test with whole than with shelled corn and equally as good as with meal. A reasonably quick finish may be secured without the feeding of an excessively heavy grain ration.

"The feeding of a nitrogenous concentrate to supplement corn undoubtedly stimulates the appetite and increases the capacity of the steer for consuming to advantage large quantities of concentrates. Hence this system of feeding is to be recommended where a quick finish is desired." Corn meal was more efficient than corn-and-cob meal or shelled corn, but not more efficient than ear corn. Chaffing the hay and mixing with a ground concentrated feed did not materially increase the efficiency of the grain for beef production, although by this system of feeding there is less likelihood of the steers getting off feed or of scouring.

As regards profit to the cattle feeder, the 3 rations which gave the best results were ear corn supplemented with oil meal and gluten meal, shocked or fodder corn and ear corn, and ear corn without additional concentrated feed, the 3 rations being so nearly alike that it would be unwarranted to say that either would prove superior. The 3 rations which gave the smallest net profits were shelled corn (fed in an unpaved yard), corn-and-cob meal, and corn meal fed with chaffed hay.

"The results of this experiment are so striking that it appears that the grinding of corn for feeding choice 2-year-old steers during the winter season is not warranted. The profits of feeding ear corn are fully twice as large as those secured in feeding corn meal or corn-and-cob meal. . . . [However,] it should not be assumed that it does not pay to grind corn for cattle that are being fattened in summer on grass. . . .

"The feeding of silage in moderate quantities is not necessarily conducive to heavy shrinkage in shipping or small percentages of dressed beef. The reader is cautioned not to conclude that since the feeding of silage was not followed with as large profits as the feeding of several other rations, that it has no place in beef production. Its use in growing young cattle and as a part of the ration of the breeding herd promises well in the hands of the experienced feeder, but to just what extent it may be profitably used for these purposes remains to be determined by future investigations.

"Many who advocate the feeding of ear corn to cattle if hogs follow, advocate the feeding of meal if for any reason it seems desirable to eliminate the hog. The results of this experiment do not warrant such a conclusion. After eliminating the hog from the cattle-feeding operations here presented the feeding of broken-ear corn was followed with larger profits than the feeding of meal."

As regards the gains made by the pigs, "the most striking points of importance brought out . . . [by the results of the test] are the relatively small amount of pork produced from the droppings of the silage-corn-meal-fed steers; the large gains made by the pigs following the shelled-corn-fed steers; and the fact that the pigs following the ear-corn-fed (without nitrogenous concentrates) steers made larger gains than did those in the lot where ear corn was so supplemented. . . . The amount of gain made by hogs following steers appears to be largely regulated by the amount of undigested corn in the droppings of the steers in an available form for the hogs to recover; therefore larger gains are made by hogs following steers fed corn

only than where it is supplemented with oil meal and gluten meal, thus rendering it more efficient for beef production."

Influence of rations upon the hydration of body tissues in cattle, A. Gouin and P. Andouard (*Compt. Rend. Soc. Biol. [Paris], 58 (1905), No. 17, pp. 813-815*).—Rations rich in carbohydrates (molasses) and nitrogenous rations were found to produce marked differences in water content of the tissues. The bearing of such facts on the study of animal nutrition is discussed. The authors intend to continue their observations along this line.

Raising calves on separator milk, H. T. French (*Idaho Sta. Bul. 48, pp. 17, figs. 5*).—The author studied the feeding value of skim milk with 5 scrub calves, dropped from February 25 to April 8, 1902.

The calves were separated from their dams within 48 hours after birth, and were given 2 feeds of whole milk daily for 5 to 7 days. At the end of that time warmed separator skim milk was gradually substituted for the whole milk. From the start whole oats were fed with the skim milk, the amount at first being not more than a tablespoonful, which was placed in a box in front of the calf after it had taken the milk. The animals readily learned to eat the oats, and at the end of 3 or 4 weeks, according to the author, ate about a pint a day.

When on full ration the calves ate not far from a gallon of skim milk at a feed, and the author cautions against feeding too large amounts. The calves were fed in stanchions, and learned to drink the milk readily. After they had eaten they were turned into a box stall and had access to a good quality of hay and to fresh water. When the calves were 4 to 6 months old the skim-milk ration was gradually withdrawn and the oat feeding continued. Early in May they were turned on pasture. In the fall they were placed in stalls and given a ration of hay and carrots.

From the beginning of the experiment until February 9, 150 days, the average daily gain was 1.59 lbs. per calf, and the cost of feed per pound of gain, not including pasturage, 2.13 cts. At the close of this period the feeding test was continued for a year, the ration during the winter consisting of corn silage, hay, and carrots, and during the summer of pasturage, supplemented during a part of the time by clover, mixed rye, and vetch, and alfalfa as soiling crops. During the fall and early winter oats were added to the ration, and green corn, and later carrots. When 2 years of age the calves were slaughtered, the average weight being 1,013 lbs.

Considering the test as a whole, the average daily gain from birth was 1.46 lbs. During the summer when flies were very troublesome it was found desirable to pasture the calves at night and keep them under cover during the day. From 6 to 12 months is considered the critical age for calves fed skim milk. The animals "develop a stomach out of proportion to the rest of their body, and their coat is not quite as smooth as it is when calves run with their dams. However, the calves have learned how to eat and digest coarse feed in larger quantities than calves reared on whole milk. The digestive organs are better developed for practical feeding, from this period on to maturity, than in calves fed whole milk."

The deductions which the author drew from the test follow: "It is possible to raise calves profitably on separator milk by substituting whole oats in place of the butter fat which has been removed. . . . We have found that an oat with a thin hull is best. . . . Calves fed in this way will do better on coarse feed alone than those raised on whole milk. Early maturity is not hindered by this method of feeding. The value of butter fat saved was more than 4 times the value of the oats consumed. There was $18 profit per head over and above cost of feed. The steers were sold as 'baby beef' at an average age of twenty-two and one-half months. The steers made an average gain of 2 lbs. per day during a portion of the time (128 days) on coarse feed alone."

Soy beans, middlings, and tankage as supplemental feeds in pork production, J. H. Skinner (*Indiana Sta. Bul. 108, pp. 15-32, figs. 4*).—Believing that corn

meal should be supplemented by some more concentrated feed, middlings, soy-bean meal, and tankage were tested for this purpose, using 4 lots of 4 crossbred pigs each. The feeding stuffs used were analyzed.

On the corn meal alone the average daily gain per pig in the 3 months of the test was 2.18 lbs. and the feed eaten per pound of gain 5.57 lbs. With the lot fed corn meal and middlings 1:1 similar values were 4.35 lbs. and 3.43 lbs. With corn meal and soy beans 2:1 the average daily gain was 4.78 lbs. and the feed eaten per pound of gain 3.11 lbs., and with corn meal and tankage 5:1 the values were 4.15 lbs. and 3.31 lbs.

In the case of the corn-meal ration the nutritive ratio was 1:13.3. On the rations containing wheat middlings, soy-bean meal, and tankage it was, respectively, 1:8, 1:5.1, and 1:5.2. The cost of feed per pound of gain was not far from 3.5 cts. on an average with all the lots fed corn meal supplemented by concentrated feed and was a little over 5 cts. on corn meal only.

"Corn alone is not a desirable feed for hogs; especially is this true in the case of young growing pigs and breeding stock. This was evidenced in the test under consideration by the small gains, poor appetites, lack of bone, poorly developed carcasses, harsh skin and hair, and a sharp, rasping, complaining squeal rather than the contented grunt so well recognized by swine growers. Perhaps the greatest need for some adjunct to corn on the average farm occurs during the winter months, in the case of fall or winter pigs and brood sows, as they usually have access to more or less grass, clover, etc., during the summer. . . . It takes favorable conditions and good feeding to make a profit [on corn meal only] on the late fall pig. Too frequently they are carried through at a loss, much of which might be avoided by a more judicious use of corn. Doubtless less corn and more of other feeds, such as milk, shorts or middlings, soy beans, tankage, and oil meal would greatly increase the profit on fall pigs.

"Middlings among other feeds is generally recognized as a desirable feed to combine with corn. In this test it proved to be the most profitable so far as money return was concerned. It is quite commonly used and has proved very effective in other tests. It is generally appreciated by swine growers, but high priced and difficult to secure.

"Tankage, although less widely known, has desirable qualities. In this test it did not give as favorable results as middlings or soy beans. This was doubtless due, in part, to the fact that one pig in the lot receiving tankage did not seem to make efficient use of the feed consumed during a portion of the time. . . .

"Soy beans are not commonly used in pork production. This is doubtless due to lack of knowledge of their characteristics and value."

Poultry suggestions for the amateur, C. K. GRAHAM (*Connecticut Storrs Sta. Bul. 36, pp. 12, figs. 9*).—The kind of eggs which should be selected for hatching, packing eggs for shipment, nests for setting hens, incubators, care of young chicks, and other related topics are discussed.

Poultry experiments, G. M. GOWELL (*Maine Sta. Bul. 117, pp. 93–116*).—The station work in breeding laying stock is reviewed; the proposed work which has to do with the amount of floor space required by poultry and related topics is outlined; the poultry houses at the station, including one recently built, are described; sample pedigree charts like those used in breeding tests are given, and the results of several tests on breeding and feeding are reported.

The author's experience convinces him that the use of trap nests is very desirable in selecting poultry in connection with breeding for improved stock, but suggests that where this is not practicable early maturity in pullets may be a basis for such selection. This was shown by a lot of 29 April-hatched pullets selected because they had begun to lay in the latter part of August. From September 1 until April 30

following these birds laid on an average 115 eggs each at a calculated profit of $3.01 per bird.

"While the egg yields of this group of birds were very satisfactory, the money returns from them were particularly so, for the reason that they did their work during that part of the year when prices were highest. . . . Early maturity in pullets is generally accompanied by physical vigor and when the function of such birds is to produce eggs, and they give evidence of it, they are certainly the best of their race to breed winter egg producers from, if we accept past experiences in breeding as our guides."

Eggs from hens over a year old have given larger chicks and larger mature birds than those from younger stock, yet in chicks from eggs laid by vigorous pullets showing early maturity "we have never been able to discover any lack of constitution or vigor . . . and know no reason why they are not desirable as workers."

At the station work has been carried on with the same family of Barred Plymouth Rocks for 25 years, and methods of feeding have been developed which are considered satisfactory. Throughout the year each pen of 22 chickens received 1 pt. of wheat early in the morning, a half pint of oats at 9.30 a. m., and a half pint of cracked corn at 1 p. m., these grains being scattered in litter. At 3 p. m. in winter and 4 p. m. in summer they were given all the mash they would eat up clean in half an hour composed of wheat bran, corn meal, wheat middlings, linseed meal, gluten meal, and beef scrap 2:1:1:1:1:1, with one-fourth of its bulk of soaked clover leaves and heads added. Cracked bone, oyster shell, grit, and water were always supplied, and each pen was also given 2 large mangels daily. "Very few soft-shelled eggs were laid, and so far as known not an egg has been eaten by the hens during the last 5 years."

The records which have been kept show that 50 to 55 lbs. of the dry meals were eaten per hen per year on an average in addition to 18.2 lbs. wheat, 6.4 lbs. cracked corn, 5.8 lbs. oats, 5.9 lbs. oyster shells, 3.2 lbs. dry poultry bone, 2.9 lbs. mica grit, and 40 lbs. of mangels. The straw required for litter has averaged 36 lbs. per bird per year. The average egg yield has been about 150 eggs each. "The amount of food required by the birds kept in this house [where the temperature was at all times above the freezing point] . . . was always less during the winter season than where birds were kept in the colder houses."

The value of cracked corn and beef scrap compared with the moist mash mentioned above was tested with 300 pullets divided into 2 equal lots. The moist mash was fed toward evening, as was also the dry cracked corn, which was supplied ad libitum in troughs. The dry beef scrap was kept within reach of the poultry at all times. The cost of feed and straw of the lot receiving the mash was $1.73 per bird per year and of the lot receiving dry feed $1.69. The yearly egg yield was 151 per chicken on moist and 149 on dry feed. So far as could be judged by egg yield, appearance, or health, no marked difference could be noted in the two lots. When the birds helped themselves to beef scrap they ate on an average 14.7 lbs. per year, as compared with 8.7 lbs. in the case of those receiving this feed as a part of the mash. "The quantity of oyster shell, bone, and grit eaten by the birds having a constant supply of beef scrap was markedly less than when the supply of scrap was limited to that contained in the mash."

The value of dry feed was further tested with 550 pullets, which were not selected with special reference to their egg-laying qualities. A dry mixture of the materials used in the mash mentioned above was constantly kept before the birds in troughs with slatted fronts so that they could help themselves at will. At first they were not used to the dry mixture and ate of it sparingly, but later ate it readily. Whenever feeds of cracked corn and oats were supplied to them "the birds were always ready and anxious for them and would scratch in the litter for the very last kernel

before going to the troughs where an abundance of food was in store." The average number of eggs laid from November 1 to April 30 was 76 per bird. The dry feeding has been found economical as regards time and waste, but the author does not consider the data extensive enough for final deductions.

The desirability of replacing a mash with dry grain and beef scrap feed supplied from separate troughs was tested with 1,400 young chickens.

"The results were satisfactory. The labor of feeding was far less than that required by any other method we have followed. The birds did not hang around the troughs and overeat, but helped themselves—a little at a time—and ranged off, hunting or playing and coming back again when so inclined to the food supply at the troughs. There was no rushing or crowding about the attendant as is usual at feeding time where large numbers are kept together. While the birds liked the beef scrap they did not overeat of it. The birds [both cockerels and pullets] did well under this treatment."

From June to October the chickens ate about a pound of beef scrap to 10 lbs. of cracked corn and wheat. According to the author, "it would seem that we had not been far wrong in our previous feeding, as the birds used just about the same relative amounts of scrap to other food, when they had liberty to do so, that we had formerly mixed in for them."

No special difficulty, it is stated, is experienced in keeping the troughs clean, as they are provided with roofs which project 2 in. on either side. The troughs used at the station are 6 to 10 ft. long, with sides 5 in. high and slats above. The lath slats are 2 in. apart, the total height of the trough being 16 in.

The system of feeding chickens followed at the station is outlined. For 2 or 3 days after hatching they are supplied with a mixture of infertile eggs (shells included) boiled for half an hour, ground in a meat chopper, and mixed with about 6 times their bulk of rolled oats. After about the third day a mixture of hard, finely broken corn, wheat, millet, and pin-head oats is also fed, and when the chicks are about 3 weeks old the rolled oat and egg mixture is gradually replaced by a moist mash made of a mixture of bran, corn meal, middlings or Red Dog flour, linseed meal, and fine beef scrap 2: 2: 1: 1: 1, wet up with a little water. The hard broken grains, it is stated, may be safely used all the time instead of the meal mixture, but the chicks do not grow so fast as when the mash, which should be rather dry to prevent looseness of the bowels, is fed.

Poultry experiments, J. DRYDEN (*Utah Sta. Bul. 92, pp. 115-197, figs. 25*).—*Chickens* (pp. 115-175).—Photographic records and the egg yield of a number of hens were kept to secure data which would show whether hens with long bodies and wedge-like forms, small heads, etc., are the best layers. The author states that this theory was not borne out by his experiments, some of the hens of a given type being poor layers and others good layers.

Records of the egg yield of hens showed wide variations in both the number and size of the eggs, and the author believes that laying qualities can be transmitted and that by proper selection a strain of fowls can be produced that will lay eggs of uniform color. As an illustration of the influence of good breeding, the record of 5 White Wyandotte pullets is given which averaged 189 eggs per year, an increase of 27 per cent over the average egg yield of their dams. As regards the color of eggs, great variation was noted with all breeds except Leghorns and Dorkings, which laid eggs uniformly white in color.

"In our tests it was very rare that we found 2 Wyandottes or 2 Plymouth Rocks laying eggs of the same color. The colors vary all the way from nearly white to the typical brown. The same hen, however, lays eggs of very little variation in color; occasionally she would lay an egg that was 'off-color.' Eggs from the same hen varied in size sometimes as well as in color."

The earlier work of the station (E. S. R., 12, p. 674), on the value of exercise for laying hens, was continued. Considering results extending over a number of years, the average egg yield per hen when the grain was scattered in the straw was 169, and when fed in boxes 161. With Leghorn hens good results have been obtained when all the feed was placed in a box, and there was apparently no advantage with this breed in making the hens scratch for their grain. When a Brown Leghorn, a White Plymouth Rock, and a White Wyandotte were kept in a small pen with board floor without straw or litter, the egg yield was respectively 52, 38, and 33 eggs per year. The fowls showed weakness in their legs at times, but the Leghorns seemed to bear the enforced idleness best. With Barred and White Plymouth Rocks the results were decidedly in favor of scattering the grain in straw litter.

In a comparison of different breeds for egg production for several years the average profit per hen was 51.5 cts. per year with Barred Plymouth Rocks, 88 cts. with White Wyandottes, and $1.12 with Rose Comb Brown Leghorns. Marked differences were observed in the size of the eggs laid by hens of different breeds and of the same breed, but, in general, the Leghorns showed less variation than Wyandottes or Plymouth Rocks. In the case of 41 hens of different breeds, for which complete records were kept for 2 years, it was found that the average egg yield was 178 per fowl the first year and 125 the second. "Whether there is a characteristic difference in the different breeds in this regard our experiments have not been continued long enough to form a basis for conclusion. The records show, however, that individualism must be taken into account, in a few cases more eggs being laid the second year than the first."

The relative value of fresh meat scraps, cut green bone, commercial meat meal, and milk albumin (a by-product of milk-sugar factories) was tested. The lot fed commercial meat meal average 133 eggs per fowl per year, as compared with 201.5 eggs in the case of a similar lot fed fresh meat scraps or cut green bones, and the lot fed milk albumin averaged 101 eggs, as compared with 143.5 in the case of a similar lot fed scraps. In a second test the average number of eggs per fowl per year on meat meal was 119, as compared with 154 on meat scraps and 189 on cut green bones. In the author's opinion the data presented are not sufficient to warrant the definite conclusion that the better egg yield with the fresh meat scrap was due to its higher percentage of fat and ash, but "they appear to indicate that in feeding for eggs the poultryman will be able to accomplish with cheap fat, or cheap foods rich in fat, what he has been vainly striving to accomplish with expensive protein."

As to the possibility of increasing the yellow color of egg yolk by feeding, it was found that when hens were fed dried alfalfa leaves in winter, the yolks of the eggs laid were normal in color, while those laid by similar lots fed no alfalfa were pale in color, and the same improvement in color was noted when hens had access to green grass, alfalfa, and clover. In another test, a mixture of white and yellow corn eaten in place of wheat did not produce yellow yolks, nor did skim milk fed in place of meat meal. "It was not noted that there was any difference in color of yolk from different breeds, nor did there appear to be any difference due to individuality. The color of shell is a question of individuality, but the proper color of yolk is a question of food."

Incubator experiments (pp. 175–191).—The results of weighings showed that eggs in incubators lost weight more rapidly than those under setting hens, and indicated that the ventilation was greater in the incubator. The air from incubators showed a much smaller amount of carbon dioxid than that found under setting hens. "From these tests it appeared that the theory that the chicks died in the shells because of insufficient ventilation or [an excess of] carbonic-acid gas was not well founded; rather, the results indicated that the cause was too much ventilation and too little carbonic-acid gas."

Tests of the effect of carbon dioxid with and without water on eggshells as a possible aid to the chicks in breaking the shell showed that when water was present carbon dioxid weakened or entirely dissolved the eggshells, but that dry carbon dioxid apparently had no influence. The thin membrane inside the shell was not affected in any case. "It is intended to continue these tests further to determine what amount of ventilation, if any, and of applied moisture, if any, are necessary for successful incubation."

Growing ducklings (pp. 191–194).—With a view to securing data relative to the cost of raising ducks, 5 newly hatched Pekin ducks were fed for 9 weeks a mixture of ground grains and skim milk in the form of a mash, with cut bones and a little green alfalfa. The grain consisted of bran, shorts, wheat, corn, rolled oats, and linseed meal, in varying proportions. At the close of the period the ducks had made a total gain of 27.3 lbs. Each pound of gain required 3.02 lbs. grain, a like amount of skim milk, and 0.16 lb. meat scrap, the cost being 3.93 cts.

At the close of the period 2 of the ducks were fed for 5 weeks longer and gained only 0.8 lb. The food required per pound of gain was 22.5 lbs. of grain, a like amount of skim milk, and a pound of cut bone, very much larger amounts than during the first period.

"It is the practice of the large producers to market the ducks at the age of about 10 weeks. The market demands young ducks. At this age they bring the best profit to the producer. If kept longer they begin to grow new feathers, and the food they eat is largely used in the making of feathers. Further growth is checked, and to feed them beyond this period is unprofitable."

Fattening turkeys (pp. 195–197).—The possibilities of profitably feeding turkeys in confinement and improving the quality of the flesh was tested with a lot of 6 nearly mature birds, kept in a small pen with an open front closed by a curtain. Whole wheat was scattered in straw litter in the morning, corn was fed at noon, and a grain mash at night. The turkeys were also given skim milk, sugar beets, and alfalfa leaves, with grit or gravel. One of the turkeys was sold at the end of 3 weeks, the others were fed for 4 weeks.

Considering the test as a whole, the 6 turkeys made a total gain of 16.4 lbs., of which 13.2 lbs. was made by 4 birds. When bled and plucked the turkeys lost 7 per cent in weight. The author calculated that there was a profit of $3.54 on an original investment of $8.50. "As to the quality of meat, those who ate it reported that they never ate better turkeys. There was no question about the quality of meat being greatly improved. The 2 smaller turkeys were not in as good condition as the others, but the meat was excellent."

"This experiment shows that young turkeys may be taken from the farm and fed in small pens at a profit; second, that the quality of the meat is greatly improved by such feeding."

Egg preservation, J. S. JEFFREY (*North Carolina Sta. Bul. 191, pp. 11-17*).—Different methods of preserving eggs were tested.

A 10 per cent solution of water glass gave very satisfactory results, the eggs keeping well from June until the following May. "Some of those used in December so closely resembled fresh eggs that it would take an expert to tell which were the fresh eggs and which were the packed ones after they were cooked." A 20 per cent solution of water glass did not give as satisfactory results. Though none of the eggs were spoiled, the whites in some cases were slightly coagulated and some of the eggs would not sink to the bottom of the solution.

A lime and salt solution gave as satisfactory results as water glass, none of the eggs being spoiled. A solution of lime and salt with British Egg Preserver (borax and sodium bicarbonate) also gave good results, "but it could not be seen that the addition of the preserver gave any returns for the money it cost and trouble of using." A solution of salicylic acid in water (1 oz. to a gallon) gave good results, none of the

eggs being spoiled, but it did not leave the eggs in as good condition as the water glass or the lime and salt solutions, since the acid weakened the shells.

Eggs were also coated with salicylic acid and cotton-seed oil with and without alcohol, with paraffin, collodium, and gum arabic, and then packed in cotton-seed hulls. Conclusions could not be drawn as to the value of these preservatives since the eggs were accidentally destroyed. However, the author is convinced that these preservatives and others of a similar character "are not as satisfactory as the liquid preparations, because of the extra labor in putting up and the evaporation that takes place, leaving the eggs shrunken in appearance when broken."

The report contains brief directions for testing eggs.

Experiments in the artificial rearing of oyster fry, J. NELSON (*New Jersey Stas. Rpt. 1904, pp. 415-446, pls. 9*).—A progress report is made of the investigations on the breeding of oysters. The conditions were unfavorable and general deductions were not drawn.

The construction of artificial inclosures called "claires," in which the oysters were kept and the character of the water controlled with reference to sediment, etc., are described. In one of these the water was filtered through several thicknesses of absorbent cotton quilted between sheets of galvanized wire netting of a quarter-inch mesh. Generally speaking, the oyster spawn during the past season was of poor quality. It was noted that sets of oyster spat were found in places where the water was very salt and in others where it was diluted with fresh water.

"So we can not conclude that a certain amount of fresh water is absolutely needed to induce a 'set.' It seems more likely that in those seasons characterized by a poor set, the result is due to a poor character of the spawn, owing to some previously acting influences on the mother oysters. This point needs careful investigation. . . . The experiences of previous seasons had led us to believe that the very climax of the spawning season occurs late in June, and that . . . southern seed would furnish an ample supply of spawn up to at least the latter part of August. Indeed, spawn is sometimes present in such oysters, and also in 'native' plants until quite late in the autumn.

"Oystermen are certain that there is a set of spat at the close of the spawning season of exceptional amount, known as the 'September set,' which may be due to a special increase in the spawning process early in September." It was found that late in June the oysters had already spawned to a greater or less extent.

"The eggs that remained in the half-filled oysters presented a poor appearance under the microscope. Many of them possessed ruptured shells, swollen nuclei, coarsely granular yolk, spherical shape, etc. Such an appearance leads me to believe that this spawn never is ejected, but is absorbed. Such absorption, or, at least, the disappearance of this spawn, was very slow, lasting at least to the middle of September, for a majority of the oysters.

"A certain proportion of the eggs in spawn of this character will be fertilized, and will undergo development, at first apparently quite normally, but finally they break down and disintegrate.

"It appears extremely probable that the character of the spawn, and therefore of the 'set' of seed, is determined by influences acting on the spawning oysters during the spring and early summer. It becomes, therefore, important to study how oysters are affected by surrounding conditions."

The histology of oysters was studied in detail, this phase of the work being illustrated by plates. (For earlier work see E. S. R., 16, p. 501.)

DAIRY FARMING—DAIRYING—AGROTECHNY.

Practical guide to dairying, R. T. ARCHER and P. J. CARROLL (*Jour. Dept. Agr. Victoria, 3 (1905), No. 4, pp. 279–329, pls. 12, figs. 8*).—This contains an introduction on the selection and preparation of land for a dairy farm and chapters on breeding, feeding, and management of cattle; common ailments of dairy cattle; dairy farm buildings; fodder for the dairy herd; dairy management; and milk testing.

Farm dairying, J. C. KENDALL (*North Carolina Sta. Bul. 192, pp. 19–48, figs. 9*).—This is a popular bulletin dealing with the various phases of dairying, with special reference to North Carolina conditions.

External conformation and productive capacity of cattle, H. ATTINGER (*Beiträge zur Kenntnis von Körperform und Leistung des Rindes. Leipsic: R. C. Schmidt & Co.; rev. in Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 1, p. 103*).—This volume deals especially with the question of the relation between external conformation and productive capacity in milch cows.

Report of the dairy husbandman, G. A. BILLINGS (*New Jersey Stas. Rpt. 1904, pp. 341–412*).—The first part of this report deals with soiling crops and is abstracted elsewhere (p. 353).

For 8 years the dairy herd has been fed soiling crops from May 1 to November 1 each year and silage for the remaining 6 months. On soiling crops the average production was 3,322 lbs. of milk and 167 lbs. of butter and on silage 2,997 lbs. of milk and 152.5 lbs. of butter. The cost of the roughage was also in favor of the soiling crops.

Dried beet pulp was compared with dried molasses beet pulp as regards influence on yield of milk and butter, effect on quality of milk, and relative cost of milk and butter. The test was made with 4 cows and lasted 30 days and indicated that the addition of beet molasses to beet pulp is no advantage in feeding for the production of milk. On the ordinary or unsweetened dried beet pulp the average daily yield of milk was 0.33 lb. and the yield of butter 0.02 lb. greater than on the dried molasses beet pulp. The relative cost of producing 100 lbs. of milk on the 2 rations was, respectively, 67.2 and 69.8 cts.

A similar comparison was made of dried molasses beet pulp and hominy meal. With rations otherwise alike 8 lbs. of dried molasses beet pulp produced 1.36 lbs. more milk and 0.09 lb. more butter per cow per day than 7 lbs. of hominy meal. The relative cost of producing 100 lbs. of milk on the 2 rations was, respectively, 68.9 and 78.1 cts. The hominy meal contained 8.41 per cent crude fat and the dried molasses beet pulp 0.42 per cent, yet the average fat content of the milk was 0.04 per cent higher on the pulp ration.

The usual monthly record of the dairy herd is given. The average yield for the year was 5,642.2 lbs. of milk or 280.58 lbs. of butter. The best cow produced 8,752.3 lbs. of milk and the poorest cow 3,443.9 lbs. The average cost of food per cow per year was $47.12. With milk at $1.00 per 100 lbs., 21 cows returned a net profit over cost of food of $22.39 per cow, while 11 cows were kept at a loss of $2.25 per cow. The average cost of producing 1 qt. of milk was 1.83 cts. for food and 1.03 cts. for labor and interest on the capital invested, or a total of 2.86 cts; the average for 8 years was 2.43 cts. The record of 1 Guernsey cow entered in the Advanced Register during the year was 8,603.4 lbs. of milk and 369.34 lbs. of fat.

The usual data are given on the fertilizing elements in the feeding stuffs purchased and the milk sold. The total gain to the farm in 8 years was 11,868 lbs. of nitrogen, 8,879 lbs. of phosphoric acid, and 2,836 lbs. of potash.

The hand separator was compared with the deep-setting system of creaming without ice. The average fat content of the separator skim milk for 8 days was 0.022 per cent as compared with 0.95 per cent with the gravity system.

Should dairy cows be confined in stalls? W. J. FRASER (*Illinois Sta. Circ. 93, pp. 25, figs. 24*).—This circular contains information obtained from 18 practical dairymen on the results of allowing cows the freedom of a closed shed or covered barnyard instead of confining them in stables. The greater part of the data is presented in tabular form and illustrations are given of many of the barns.

The very favorable results reported by the dairymen led the author to put the method into actual operation at the University of Illinois. Twenty-two cows were cared for in this way, with very satisfactory results. It was found that the cows kept much cleaner than when stabled, that the milking stable was in a more sanitary condition, and consequently that it was easier to produce clean milk. The cows were believed to be more vigorous and healthy than when kept in the ordinary stable. The saving of labor and also of manure are other strong points advanced in favor of this practice.

"The information at hand is not sufficient from which to draw definite conclusions for all sections of the country and all conditions. A tentative report is now published, as this system has been a marked success wherever we can find that it has been tried, and it seems probable that it could be put into practice by many dairymen of the State greatly to their advantage and to the general improvement of the milk supply." The station is desirous of communicating with all who have had experience in keeping cows in this manner and of receiving suggestions and criticisms concerning the method.

Suggestions for the improvement of dairy barns, H. A. HOPPER (*Illinois Sta. Circ. 95, pp. 20, figs. 15*).—The subjects discussed in this circular are the construction of floors, the interior arrangement of the barn, fastenings for cows, ventilation, and whitewashing.

Tests of materials for bedding cows, C. F. DOANE (*Maryland Sta. Bul. 104, pp. 9*).—Cut wheat straw, cut corn stover, sawdust, shavings, and rye straw were compared with uncut wheat straw as regards the quantity required to keep cows clean. Tests were also made of the absorptive power of each of the materials mentioned.

Cut wheat straw was not found as satisfactory as uncut wheat straw. At the rate used in the experiments, 2,300 lbs. of the cut straw as compared with 1,800 lbs. of the uncut straw would be required per cow yearly in order to keep the animals equally clean. About one-third more by weight of cut corn fodder was required to accomplish the same results as wheat straw. The corn fodder was considered better bedding material than the straw, and where wheat is grown purposely to secure straw for bedding purposes it is believed that corn fodder might well be substituted to a considerable extent. Sawdust was found the most satisfactory of the bedding materials used. Good results were also secured with shavings. These two materials are believed to be ideal bedding materials in sanitary dairying. Rye straw was not thought to be as good as wheat straw for cows.

From the results of laboratory tests as to the amount of water capable of being absorbed by each of the materials used, it was estimated that 2.8 lbs. of cut stover, 3.3 lbs. of wheat straw, 8.3 lbs. of sawdust, or 3 lbs. of shavings would be required to absorb the liquid manure produced by 1 cow in 16 hours. The yearly cost of bedding for cows stabled the entire day was estimated as follows: Cut stover $3.65, cut wheat straw $4.82, uncut wheat straw $4.15, sawdust $0.45, shavings $4.81.

Concentrated feeding stuffs and stage of lactation, A. OSTERMAYER (*Österr. Molk. Ztg., 12 (1905), No. 9, pp. 117-119*).—This is a report of an experiment with 17 cows, the results of which showed greater profit in feeding an additional supply of oil cake to cows in early than in late stages of lactation. In the first of the 3 periods of the experiment 9 of the cows were fed the additional feed with profit, while in the third period the number was reduced to 3.

Increasing the fat content of milk by feeding, P. DIFFLOTH (*Indus. Lait. Belge, 6 (1905), No. 35, pp. 276-279*).—Using the data obtained at the dairy tests at

the Chicago and St. Louis expositions and the results of some experiment station work in this country and of investigations in Belgium, the author concludes that the productive capacity of cows as regards yield of milk and butter may be increased by suitable feeding, though the percentage of fat in the milk remains practically unchanged.

On the influence of asparagin on the production of milk and its constituents, T. PFEIFFER, A. EINECKE, and W. SCHNEIDER (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 2, pp. 179–225*).—In experiments with 6 goats lasting 2 years, the substitution, in quantities having equal fuel value, of a mixture of asparagin and cane sugar for a part of the proteids in a ration moderately rich in protein produced (1) no decrease in the yield of milk, but an increase in individual instances; (2) a lowering of the percentages of fat, proteids, and total solids in the milk; (3) a distinct reduction in the actual yield of fat; (4) unessential variations in the actual amount of proteids produced, and (5) an unfavorable influence on the increase in live weight of the animals.

Asparagin or the amids in general are, therefore, according to the authors, to be stricken from the list of nutrients. In rations very rich in food constituents the amids on the contrary are able, on account of their irritating or stimulating actions, as yet not satisfactorily explained, to exert a favorable influence on milk secretion, but always at the expense of other food constituents or body tissues.

Daily variations in the fat content of milk, M. SIEGFELD (*Molk. Ztg., 19 (1905), No. 38, pp. 975–978*).—The mixed milk of each of 14 dairy herds was tested daily for 1 year. Data are presented showing variations in fat content for short and long periods and causes of these variations are discussed. The fat content of the mixed milk of 1 herd milked 3 times daily was 2.91 per cent in the morning, 3.53 per cent at noon, and 3.18 per cent in the evening. In another instance the percentages were, respectively, 2.56, 3.65, and 3.10.

Variations in the yield and fat content of milk during one year, HARNOTH (*Molk. Ztg., 19 (1905), No. 28, pp. 712–714*).—Records of 20 dairy herds are summarized and used in this discussion of the causes and extent of variation in the yield and fat content of milk. The average fat content for the year was 3.24 per cent. Monthly variations ranged from 3.13 to 3,39 per cent.

On the origin of lactose, C. PORCHER (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 10, pp. 467–469*).—In studying the source of lactose in milk the author made hypodermic, intraperitoneal, and intramammary injections of glucose, using for this purpose cows, goats, and dogs in full lactation. Hyperglycemia under such conditions tended to produce lactosuria instead of glycosuria.

On the agricultural production of milk for infants, P. DIFFLOTH (*Indus. Lait. Belge, 6 (1905), No. 37, pp. 289–293*).—The suitability of various feeding stuffs for cows used in the production of milk for infants is discussed.

Principles and experiences in the preparation of milk for infants, BACKHAUS (*München. Med. Wchnschr., 52 (1905), No. 39, pp. 1883–1885*).—The author for years has advocated in infant feeding the so-called aseptic milking, the modification of the milk in suitable establishments rather than in homes, bottling, and sterilization, and in this article outlines the methods employed and comments on the good results obtained.

A discussion on infant milk depots, B. W. F. ANDERSON, N. STRAUS, ET AL. (*Brit. Med. Jour., 1905, No. 2333, pp. 643–647*).—This is a presentation of the work being done in Glasgow, New York City, and other places in furnishing a wholesome milk supply for feeding the children of the poor. The report on the Straus depots in New York is especially full.

The nutritive value of sterilized cow's milk, R. BRUNON (*Bul. Acad. Méd. [Paris], 3. ser., 53 (1905), No. 16, pp. 396–399*).—During 4½ years the infant milk depot in Rouen, known as the Goutte de Lait, distributed 223,000 liters of sterilized

milk, used in the feeding of about 2,000 infants, of whom 70 per cent suffered with malnutrition. The milk furnished was sterilized and modified. The composition, as shown by one analysis, was as follows: Fat 4.03, lactose 5.37, casein 2.85, and calcium phosphate 0.405 per cent.

There was no question as to the nutritive value of the milk in the great majority of cases. In numerous cases of enteritis it was believed to have had a curative effect. No case of Barlow's disease developed. Only a small number of infants failed to do well. Sterilization in an autoclave at 102° C. for 45 minutes does not, therefore, in the experience of the author, destroy the nutritive value of milk, and it is believed that the health of the infants consuming the milk is a better standard for judging than analytical data.

New methods of sterilizing milk and cream with reference to Danish milk, M. Riegel (*Molk. Ztg., 19 (1905), No. 30, pp. 763, 764*).—This is essentially a discussion of Budde's method of sterilizing milk with hydrogen peroxid and Dorn's experiments with ozone. The author has observed that in milk preserved by the Budde method the fat is colorless, the aroma is destroyed, and the proteids are to a certain extent oxidized.

Comparative experiments upon chemical preservatives in milk, H. C. Sherman, A. W. Hahn, and A. J. Mettler (*Jour. Amer. Chem. Soc., 27 (1905), No. 9, pp. 1060–1068*).—This is a preliminary report on the destruction of lactose and the development of acid in milk treated with sodium fluorid, sodium salicylate, and a mixture of boric acid and borax. Brief notes are also given on the determination of these preservatives and on the use of hydrogen peroxid as a milk preservative. A discussion of the effects of preservatives upon the wholesomeness of milk is being deferred until the completion of the experiments in progress. The results so far obtained are summarized as follows:

"Milk kept at 20 to 25° without preservative showed a rapid increase in acidity and decrease in percentage of milk-sugar during the first 3 to 6 days, after which the acid fermentation proceeded much more slowly, but neither the destruction of lactose nor the formation of acid had ceased entirely after 4 weeks.

"Hydrogen peroxid, sodium fluorid, sodium salicylate, and a mixture of equal parts boric acid and borax were each found to diminish distinctly the development of acidity in milk when added in the proportion of 1:1,000.

"When present in about this proportion any one of the preservatives can be determined quantitatively with a probable error of 1 to 6 per cent of the amount in the milk. In the case of hydrogen peroxid, however, the preservative disappears so rapidly that the amount found present gives little indication of the quantity originally added.

"In the presence of fluorid or salicylate the fermentation is changed qualitatively as shown by the ratio of acid formed to lactose destroyed. With these preservatives it was found that occasional exposure of the samples to air, especially when the quantity of preservative present was small, led to irregular results, the final acidity sometimes exceeding that in the control samples to which no preservative had been added.

"In the experiment with samples preserved by boric acid and borax or by hydrogen peroxid such irregularities did not appear. The boron preservative had no apparent influence upon the nature of the acid fermentation. The experiments with hydrogen peroxid are only preliminary."

On the keeping properties and legal status of milk treated with lime-sugar solution, Lührig (*Molk. Ztg., 19 (1905), No. 22, pp. 547, 548*).—The solution used contained 4.2 per cent of lime and 19.7 per cent of cane sugar and was added to milk in quantities varying from 0.5 to 5.0 per cent. The acidity of the milk was reduced, the reaction becoming strongly alkaline when large quantities of the solution were added, in which case bacterial growth stopped, coagulation did not occur, and the

milk was rendered unfit for use. The addition of lime-sugar solution to milk and milk products is, therefore, considered an adulteration.

The so-called "germicidal property" of milk, W. A. Stocking, Jr. (*Connecticut Storrs Sta. Bul. 37, pp. 20, dgms. 3*).—This is reprinted, with minor changes, from the last annual report of the station (E. S. R., 16, p. 1014).

The chemical composition of colostrum with special reference to the proteids, M. Nencki (*Opera Omnia. Brunswick: Vieweg, 1905, vol. 2, pp. 840–890; abs. in Biochem. Centbl., 4 (1905), No. 11–12, p. 348*).—From the proteids of colostrum coagulated by heat are produced by hydrolysis carbohydrates, alanin, amidovaleric acid, leucin, pyrrolin carbonic acid, serin, phenylalanin, tyrosin, aspartic acid, glutamic acid, cystin, tryptophane, and other amido acids. Arginin, histidin, lysin, and ammonia are also produced.

The colostrum examined contained the following organic constituents: Casein, globulin, albumin, fat, cholesterin, lecithin, probably small quantities of the higher fatty acids, glycerol phosphoric acids, lactose, and urea. Some of the quantitative determinations were as follows. Total solids 17.19, total nitrogen 1.52, total proteid nitrogen 1.43, total proteids 9.13, nitrogen in precipitate by acetic acid 0.47, nitrogen in precipitate by heat 0.79, albuminoid nitrogen 0.077, ether extract 2.40, cholesterin 0.04, lactose 2.9, and ash 0.67 per cent.

Milk examinations, J. Szilasi (*Chem. Ztg., 29 (1905), No. 44, pp. 607, 608*).—Of 664 samples of milk collected for the most part from large dealers in Budapest during the last 10 years, 292 were pronounced pure, 300 watered, 61 skimmed, and 11 watered and skimmed. The reaction for nitrates is taken as a proof of watering, either directly or from small quantities of wash water remaining in cans not properly cleaned.

Chemical investigations relating to dairy undertaken in 1904, F. T. Shutt (*Canada Dept. Agr., Dairy Comr. Branch Bul. 6, pp. 11*).—Examinations were made of samples of milk preserved by the hydrogen-peroxid method of Budde and forwarded by F. G. Korch, of Copenhagen, Denmark. Chemical tests showed the presence of hydrogen peroxid. Bacteriological examinations by W. T. Connell showed that the milk was sterile. From the samples examined the author concludes that it is impossible to draw a favorable conclusion regarding the palatability of the milk or its suitability for general use.

Tests were made of the patented butter-making process of James Estep, for which it is claimed that by mixing with cream a certain mixture of pepsin, milk sugar, alum, and saltpeter the yield of butter is increased, the time of churning is reduced, and disagreeable flavors are removed. The results of the tests failed to support these claims.

A milk powder produced by the evaporation of whey showed the following composition: Moisture 3.73, albumin and nitrogenous bodies 12.81, fat 3.91, milk sugar (by difference) 72.27, and ash 7.28 per cent. From this analysis it is considered clear that the preparation has a distinct nutritive value, though the author doubts if the process will prove economical or the food become popular.

A cheese 26 months old was found upon analysis to be normal in composition, indicating that age and cold storage do not affect genuine cheese so as to render it liable to be confounded with an adulterated article.

Trials were made of two outfits for determining the amount of water in butter. The Carroll tester, in which the butter is melted and the separated water measured, was found entirely untrustworthy. The Geldard tester, depending upon the loss of weight when the butter is submitted to such a temperature as will result in the evaporation of the water without causing a decomposition of the fat, was found to give results in close accordance with those obtained by accepted methods of analysis.

Butter investigation, H. Lührig (*Ber. Chem. Untersuch. Amt. Chemnitz, 1904, pp. 14–17; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 12, p. 734*).—A butter showing a Reichert-Meissl number of 24.4, Polenske number of 2.1, and a

saponification number of 231.8 was pronounced adulterated with cocoanut oil, though it was shown that the cows producing the butter were fed large quantities of cocoanut cake.

Composition of Holland butter produced by dairies under government control, T. VAN SILLEVOLDT (*Über Zusammensetzung der niederländischen Butter, herstammend aus der Staatskontrolle unterstellten Molkereien. The Hague: Gen. Dir. Landw. Min. Waterst., Handel u. Gewerbe, 1905, No. 2, pp. 17; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 12, pp. 734, 735*).—Of 3,945 samples of butter examined during January, February, and March, 1905, only 4 samples showed a lower Reichert-Meissl number than 24, while during the 3 months preceding 32 samples fell below that number.

Investigations on influences in Limburg affecting the composition of butter, D. KNUTTEL (*Untersuchung der Einflüsse, welche für die Zusammensetzung der Butter in Limburg massgebend sind. Weerdt: E. Smeets, 1904, pp. 11; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 12, pp. 733, 734*).—Forty samples of butter produced under known conditions in this province of Holland were analyzed.

The refractometer number was usually low (42 to 45). The Reichert-Meissl number was generally 27, and rarely below 26. Both numbers were less favorable in the late fall, though no great variations were observed. The composition of butter is believed to be influenced by the care of the cows, the nature of the food, climate, and the condition of the soil.

Holland butter, A. JUCKENACK and R. PASTERNACK (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1-2, pp. 87-100*).—Analyses of 116 samples of Holland butter are reported. Of this number 69 were considered abnormal. Analyses are also reported of 30 samples of butter made by the authors from cream purchased from dairies in Berlin.

The data show a marked seasonal influence on the composition of the butter. The work is reported, however, mainly on account of the determination of the average molecular weight of the nonvolatile water-insoluble fatty acids, which was rarely below 260, though at certain seasons of the year somewhat higher. It is believed that this determination will prove of value in detecting adulteration.

Government butter control in Holland, A. J. SWAVING (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1-2, pp. 80-87, fig. 1*).—This is a discussion of the system employed in Holland.

The decomposition of fats, O. RAHN (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 2-3, pp. 53-61*).—The author discusses the decomposition of fat in butter, in cheese, and in the soil.

Only a few bacteria are at present known to decompose fat. This process is much more commonly brought about by fungi. The decomposition of fat takes place only in the presence of organic nitrogen. As glycerin is first attacked decomposed fats show a high acid number. Fatty acids are all equally decomposed by bacteria, while fungi show a preference for the lower acids. In the oxidation of fatty acids no by-products are produced. Fat is not decomposed under anaerobic conditions.

Characteristics of camel's butter, J. VAMVAKAS (*Ann. Chim. Analyt., 10 (1905), No. 9, p. 350*).—To accompany the analyses of camel's milk by Barthe, previously noted (E. S. R., 16, p. 1121), an analysis of an authentic sample of the butter is reported as follows: Melting point of butter 38° C., melting point of fatty acids 47°, volatile fatty acids 8.6 per cent, fixed fatty acids 88.29 per cent, index of saponification 208, iodin number 55.10, and index of refraction 20.

On Oïdium lactis and the ripening of cream and cheese, J. ARTHAUD-BERTHET (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 22, pp. 1475-1477*).—*Oïdium lactis* is found almost always in milk, cream, butter, and cheese. A temperature of 65° C. for 5 minutes suffices to destroy this organism, as well as yeasts, fungi, and numerous casein ferments. The advantages of pasteurization are pointed out and mention is made of a new form of pasteurizing apparatus devised by the author, Mazé, and

Perrier, in which the desired temperature is kept constant by the use of a liquid having the corresponding boiling point.

On the action of rennet ferments on milk and casein, E. LAQUEUR (*Biochem. Centbl., 4 (1905), No. 11-12, pp. 333-347*).—This is a critical review of literature of this subject, with a list of 122 references.

The importance of direct microscopical preparations in studying the process of cheese ripening, A. RODELLA (*Centbl. Bakt.* [*etc.*], *2. Abt., 15 (1905), No. 4-6, pp. 143-153, pl. 1*).—This deals with the technique employed and the results obtained in the direct microscopical examination of cheese, but more fully with the question of the rôle of bacteria in the ripening process. Sections were cut with the microtome and stained with carbol-thionin after the method of Gorini. A simpler method, devised by the author, was to press a small cube of cheese between two slides, remove the fat from the material adhering to the glass by means of chloroform and alcohol, and stain. Illustrations are given showing the distribution of bacteria in ripe Emmenthal, Gorgonzola, and Grana cheese.

The 3 kinds of cheese mentioned were examined by both methods at different stages of ripening. The bacteria were found to be grouped in colonies, which were variable in size and irregularly distributed through the mass of cheese. The colonies were usually of one kind, though occasionally several forms were present. The spaces between colonies were occasionally, but not usually, entirely free from bacteria.

This method is believed to be of importance in studying the causes of cheese ripening.

Notes on the article by A. Peter entitled Technical-bacteriological investigations in Emmenthal cheese making, E. VON FREUDENREICH (*Centbl. Bakt.* [*etc.*], *2. Abt., 14 (1905), No. 18-20, pp. 616, 617*).—The author discusses the article referred to (E. S. R., 16, p. 1019), commenting especially upon the favorable results that may be secured by the use of artificial rennet and pure cultures.

Annual reports of the dairymen's associations of the Province of Ontario, 1904 (*Ann. Rpts. Dairymen's Assocs. Ontario, 1904, pp. 248, figs. 17*).—This contains about 50 articles, mainly of a popular nature, dealing with various phases of the dairy industry.

Some of the tests of individual cows being made under the supervision of the Ontario Department of Agriculture are reported by C. F. Whitley. The product of 20 cows in one herd amounted in 4 months to $302, while that of 20 cows in another herd during the same time amounted to $435.

In discussing the curing of cheese, J. A. Ruddick suggests certain points in favor of cool curing at 55 to 60° F. over cold curing at 40°, gives data showing a saving of 1.41 per cent in shrinkage by cool curing as opposed to curing in an ordinary curing room, and argues for the improvement of curing rooms, summarizing the advantages of the central cool-curing rooms as established by the government.

H. H. Dean reported that in experiments at the Ontario Agricultural College in comparing pepsin and rennet for coagulating milk in cheese making, the pepsin produced a little better quality of cheese, but a decrease in yield of ½ lb. per 1,000 lbs. of milk and ½ per cent greater loss in weight during curing. Owing to the difficulty in preparing and keeping pepsin for this purpose its use is not recommended over that of rennet, but further experiments will be conducted along this line.

A technical paper on The Bacterial Contamination of Milk and Its Control, by F. C. Harrison (E. S. R., 16, p. 506) is reprinted as an appendix.

Tests of new dairy apparatus at the Danzig Exposition in 1904, B. MARTINY (*Arb. Deut. Landw. Gesell., 1905, No. 110, pp. 79, figs. 36*).—Detailed reports are made upon the separators, filters, butter workers, and other forms of dairy apparatus tested.

Casein: Its preparation and technical uses, R. SCHERER (*Das Kasein. Seine Darstellung und technische Verwertung. Vienna and Leipsic: A. Hartleben, 1905, pp. 192, figs. 11*).

Progress in the manufacture of starch, H. HANOW (*Chem. Ztg., 29 (1905), No. 67, pp. 881–884*).—A review of the progress made in this industry in 1904.

Complete treatise on the manufacture of beer, G. MOREAU and L. LÉVY (*Traité complet de la fabrication des bières. Paris: Ch. Béranger, 1905, pp. 674, pls. 5, figs. 173; rev. in Bul. Inst. Pasteur, 3 (1905), No. 17, p. 697*).

Further inquiries into the systematic leaching of grape husks for the recovery of spirit usually allowed to go to waste in ordinary practice, A. J. PERKINS and W. R. JAMIESON (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 1, pp. 24–38, figs. 2*).—Further investigations have shown that the husks carry away about 32 gal. of proof spirit per ton, or the equivalent of about 6 gal. of proof spirit per ton of grapes crushed. Of this amount about 80 per cent may be recovered by the systematic leaching of the pressed husks on the plan described by the authors here and in their previous report (E. S. R., 16, p. 267).

On the production of sweet cider, G. WARCOLLIER (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 26, pp. 1711–1713*).—In laboratory experiments good results were secured in keeping apple must under anaerobic conditions, whereby only part of the sugar was converted into alcohol before the fermentation ceased. Further experiments are to be made on a practical scale.

The national fruit and cider institute and its work, B. T. P. BARKER (*Jour. Bd. Agr. [London], 12 (1905), No. 6, pp. 321–334, figs. 4*).—In this account of the institute are given briefly some of the results so far obtained.

Twenty-eight varieties of apples and 4 varieties of pears obtained from 8 counties were analyzed and used separately in making cider. In general the cider made from a single variety was not of high quality. It is believed that the quality of a cider depends primarily on the varieties used, and that the principal characters of any variety affecting its value for this purpose are chemical composition, flavor, and rate of fermentation of juice.

In addition to securing data on the value of individual varieties for cider making, information has also been obtained on the subject of blending.

Pure cultures in vinegar making, W. HENNEBERG (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 22–23, p. 681*).—In this preliminary communication the author reports the satisfactory use of pure cultures of bacteria in vinegar making. Vinegar containing 11½ per cent of acid and entirely clear has been produced in this way.

Citric acid from lemon waste direct, A. HEINGARTNER (*Mo. Consular Rpts. [U. S.], 1905, No. 297, p. 101*).—A method of extracting citric acid from lemon waste direct is reported to have been discovered by Giovanni Restuccia of Italy. Details are not given.

VETERINARY MEDICINE.

Some important foreign veterinary investigations, E. V. WILCOX (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 545–573*).—This article is a digest of results obtained by foreign investigators in the study of tuberculosis, rabies, tetanus, anthrax, Texas fever, rinderpest, and milk fever.

Report of veterinary director general, J. G. RUTHERFORD (*Rpt. Min. Agr. Canada, 1904, pp. 49–186, figs. 15*).—The usual details and special reports are presented concerning the health of animals in various parts of the Dominion of Canada.

Hog cholera appears to be on the decrease. Attention was given to the eradication of tuberculosis and glanders. In a study of the Pictou cattle disease, results were obtained which indicate that the disease is due to eating ragwort. All attempts to transmit the disease by contagion gave negative results. Further experiments will be conducted along this line. A vigorous campaign is being carried on for the eradication of cattle mange and maladie du coit.

Brief notes are given on mange in horses, sheep scab, anthrax, blackleg, actinobacillosis, actinomycosis, swamp fever, meat inspection, quarantine, and dipping

plants. Special reports are presented by C. H. Higgins and various inspectors in different parts of the Dominion of Canada regarding cattle dips, tuberculin, verminous bronchitis in hogs, poultry diseases, etc.

The actual conceptions of experimental pathology, CHARRIN (*Rev. Sci. [Paris], 5. ser., 3 (1905), No. 10, pp. 289–296*).—In this article the author presents definitions of many terms and conceptions used in the literature relating to general pathology.

Immunization as a means of controlling contagious diseases, J. B. TIFFANY (*Mo. Bd. Agr. Mo. Bul., 4 (1905), No. 9, pp. 46–50*).—A brief discussion is presented of the field of immunization as at present understood with particular reference to anthrax, blackleg, tetanus, and hog cholera.

Anaerobic bacteria in the intestines of cattle, J. NEUBAUER (*Arch. Wiss. u. Prakt. Tierheilk., 31 (1905), No. 1–2, pp. 153–176*).—The literature relating to this subject is discussed in a critical manner in connection with a short bibliography.

The results of the author's experiments and study may be briefly stated as follows: Anaerobic bacteria in the large and small intestines of cattle are rare. They occur more frequently, however, in the large than in the small intestines. No bacilli or spores of tetanus or malignant edema were found in the intestines. The vegetative forms or spores of anaerobic bacteria taken up in the food are usually destroyed in the stomach or duodenum.

The pathogenic action of parasites in the intestines, J. GUIART (*Arch. Par., 9 (1905), No. 2, pp. 175–186*).—According to the author's investigations parasites may cause harmful effects in 3 ways: By irritating the end organs of the intestinal nerves, by secreting the toxins which destroy the red corpuscles and hemoglobin, and by producing ulcerations of the intestinal mucous surfaces thus giving opportunity for infection with pathogenic bacteria.

An infectious pneumonia of rabbits and its control by means of an antiserum, H. J. SÜDMERSEN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 3, pp. 343, 344*).—From cases of pneumonia in rabbits the author isolated a bacillus which evidently belongs to the coli group and which develops a very active toxin in cultures of bouillon. The organism may be destroyed by subjection to a temperature of 60° C. for 10 minutes. It was found that cultures thus destroyed exercised a decided vaccinating action when injected into rabbits. After repeated injections with dead cultures the blood of rabbits contained pronounced agglutinating and bactericidal properties sufficient to immunize the animal.

Furonculine, G. MITROWITSCH (*Berlin. Tierärztl. Wchnschr., 1905, No. 5, pp. 77–80*).—Furonculine is a name given to a form of beer yeast used in the treatment of animal diseases on account of its supposed antiseptic properties. It is recommended that it be administered by way of the mouth.

The author describes the powder form in which the material is ordinarily sold, and reports upon culture experiments made with this material. A number of bacilli and streptococci were obtained from this substance and the material proved to be pathogenic for mice and rabbits after administration by the intraperitoneal or subcutaneous methods. The author states that in his practice a number of cases of animal diseases have occurred in which he tried furonculine without any satisfactory results.

The remedy appeared to have no beneficial effect in the treatment of rabbits artificially inoculated with streptococci, and among 26 horses treated for contagious coryza one died of pyemia, while the majority of the rest had to be treated by surgical operation.

Investigations concerning lysoform, B. PROMNITZ (*Fortschr. Vet. Hyg., 2 (1905), No. 11, pp. 281–295*).—The appearance and chemical composition of lysoform are described in considerable detail, together with notes on its bactericidal properties toward various pathogenic organisms, including anthrax spores and the organisms of malignant edema, blackleg, hog cholera, and fowl cholera.

In order to gain information regarding the toxic properties of lysoform the author conducted experiments on rabbits, dogs, cats, horses, cattle, sheep, and chickens. In these investigations the subcutaneous, intravenous, and intraperitoneal methods were avoided. Lysoform was given by way of the mouth. As a result of the author's experiments it is concluded that lysoform is the least poisonous of the ordinary disinfectants. It appears to satisfy the ordinary veterinary requirements for an antiseptic substance, and is more effective as a deodorizer than the majority of similar disinfectants. Lysoform appears to be particularly adapted for use in veterinary obstetric practice and in the treatment of weak animals.

Crude oil as a disinfectant, F. C. QUEREAU (*Demeter, 3 (1905), No. 4, pp. 13–16, fig. 1*).—A method is described by which crude oil may be used in burning the carcasses of animals dead of anthrax and simultaneously disinfecting the ground immediately around the carcass.

The biology of tubercle bacilli of low virulence, J. BARTEL and R. STEIN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 38 (1905), Nos. 2, pp. 154–163; 3, pp. 264–271; 4, pp. 292–302*).—The authors briefly review the literature relating to this subject, and cite some of the more important references.

During the experiments reported in the paper various races of tubercle bacilli of different origin were utilized and inoculation experiments were made with various laboratory animals. Detailed notes are given on the technique of the authors' experiments. As a result of the authors' investigations it appears that in general the multiplication of tubercle bacilli post-mortem in tissues specifically altered by the bacilli probably takes place in the absence of other micro-organisms and under favorable temperature conditions, although this is not a matter of certainty.

It was possible to observe various morphological alterations in the tubercle bacilli, such as segmentation, granular disintegration, branching, and other changes of form. Dead tubercle bacilli which were low in virulence when encapsulated in organs specifically affected by the bacilli are not able to cause specific alterations or general infection in inoculated animals.

Immunization of cattle against tuberculosis and serum experiments with this disease, LIBBERTZ and RUPPEL (*Deut. Med. Wchnschr., 31 (1905), Nos. 4, pp. 139–142; 5, pp. 182–184*).—A test was made of a method of immunization recommended by Friedmann in using tubercle bacilli obtained from turtles. During these experiments the authors treated 3 cattle with tubercle bacilli from turtles and subsequently examined the serum of the treated animals.

As a result of the test the authors conclude that Friedmann's cultures are not without danger for warm-blooded animals. It appears that they produce serious intoxication and organic changes which may cause death without the development of true tuberculosis. Intravenous injections of Friedmann's cultures are not capable of protecting warm-blooded animals from later infection with tuberculosis. The injections of these cultures do not produce immune bodies in warm-blooded animals.

Immunization against tuberculosis by means of tubercle bacilli from turtles, F. F. FRIEDMANN (*Deut. Med. Wchnschr., 31 (1905), No. 5, pp. 184–186*).—This article is of a controversial nature and was written in reply to a criticism by Libbertz and Ruppel.

According to the author's experiments, guinea pigs may be successfully immunized against tuberculosis by previous treatment with tubercle bacilli from turtles. The control animals died within 3 weeks of generalized tuberculosis, while immunized animals were found to be quite free from the disease when killed and examined 70 days after inoculation. It is denied that the cultures of tubercle bacilli from turtles exercise any pronounced harmful action upon cattle. Cattle treated with such cultures acquire a rather pronounced immunity, which can be further intensified by inoculation with bovine tubercle bacilli.

A case of abortion and puerperal collapse due to tuberculosis, G. Ceramicola (*Gior. R. Soc. ed. Accad. Vet. Ital., 54 (1905), No. 10, pp. 217-224*).—The case observed by the author occurred in a cow and was described in detail with particular reference to the pathological anatomy and distribution of the lesions. It appeared to be a case of primary uterine tuberculosis and led to the involvement of the uterus to such an extent that abortion took place.

Reaction to tuberculin, H. Vallée (*Rev. Gén. Méd. Vét., 5 (1905), No. 54, pp. 305-310*).—This article is of a controversial nature and in it the author seeks to defend his position against the criticism of Arloing.

The author has conducted a number of experiments for the purpose of determining the length of time which ordinarily elapses after tuberculin injection before reaction occurs for the first time and at subsequent tests. According to these experiments the temperature reaction takes place much more promptly after the second or third injection than after the first. The author recommends, therefore, that after the first tuberculin injection the temperature readings be begun within 12 hours and continued for 6 to 9 hours. If the animal has been previously tested with tuberculin, however, especially if the injection has been recently given, it is recommended that the temperatures be taken within an hour or two after injection.

Fraud in connection with tuberculin test, E. Thierry (*Jour. Agr. Prat., n. ser., 9 (1905), No. 2, pp. 44, 45*).—This is a brief discussion of results recently obtained by Nocard and especially by Vallée. On account of the fact that tuberculous animals react very quickly to a second tuberculin test it is recommended that large doses of tuberculin be given in suspicious cases and that the temperatures be taken within 2 or 3 hours after inoculation.

Experience with a method for demonstrating anthrax, A. Marxer (*Ztschr. Fleisch u. Milchhyg., 15 (1905), No. 5, pp. 129-136*).—The author finds as a result of numerous experiments that the best method for securing spores in anthrax bacilli, and for preserving and shipping material containing such bacilli, is by the use of rods of plaster of Paris. This material may be formed into rods by small wires as a basis and may be of convenient length for enclosing in test tubes. Experiments with this method indicate that sporulation takes place very rapidly upon the plaster of Paris rods.

Pyrosoma diseases of cattle, J. W. Schütz (*Arch. Wiss. u. Prakt. Tierheilk., 31 (1905), No. 3, pp. 317-329*).—An account is given of various diseases of cattle due to forms of pyrosoma. Particular attention is devoted in the article to Texas fever, hemoglobinuria of cattle in Germany, African coast fever, and Trans-Caucasian pyroplasmosis. Hemoglobinuria in Germany appears to be identical with Texas fever.

Eradication of African coast fever (*Rhodesian Agr. Jour., 2 (1905), No. 4, pp. 127-129*).—It seems to be established that cattle which have recovered from the disease do not permanently remain a source of infection. In order, therefore, to free an area from African coast fever it is recommended that no susceptible cattle be introduced into the area until 12 months after the last case known to have occurred on the ground in question. Calves from immune cows should be isolated for a period of 12 months before being allowed with susceptible cattle.

The Texas fever cattle tick situation, H. A. Morgan (*Louisiana Stas. Bul. 82, 2. ser., pp. 15*).—Previously noted from another source (E. S. R., 17, p. 189).

Preventive vaccine for heartwater, D. Hutcheon (*Agr. Jour. Cape Good Hope, 26 (1905), No. 5, pp. 647, 648*).—The vaccine method of Dr. Purvis for the prevention of heartwater was tested on 40 sheep, with 10 control sheep. Of the inoculated sheep 27.5 per cent became sick, while of the controls 60 per cent were affected.

Pathogenesis and etiology of chronic hematuria in cattle, E. Liénaux (*Ann. Méd. Vét., 54 (1905), No. 4, pp. 185-198, figs. 3*).—Chronic hematuria in cattle may be due to various causes which operate as irritants upon the kidneys. Cases may be due to infestation with parasitic worms, to neomorph formations in the kidneys, and

to other causes, but all such cases are readily distinguishable from hematuria as the result of Texas fever. The disease most frequently affects cattle in a badly nourished condition, but sometimes attacks fat cattle.

Broncho-pneumonia of cattle; its association with Bacillus bovisepticus, P. G. WOOLLEY and W. SORREL ([*Philippine*] *Bur. Govt. Labs.* [*Pub.*], *1904, No. 20, pp. 21-33*).—This disease chiefly affects young animals and the symptoms vary considerably. Detailed clinical notes are given on 9 such cases in which *Bacillus bovisepticus* was found. In the cases under discussion the organism in question was not the primary pathogenic agent. Where it occurs as a primary infection the disease probably runs a more acute course. It appears that *B. bovisepticus* is quite commonly found in the respiratory tract of cattle in the Philippines.

Cattle complaint, DESMOND (*Jour. Dept. Agr. So. Aust., 8* (*1905*), *No. 8, pp. 435-438, figs. 2*).—Brief notes are presented on a disease of cattle which was not at first understood but which is apparently due to poisoning from eating rabbits destroyed with phosphorus. The symptoms and post-mortem lesions resemble those of phosphorus poisoning.

Infectious granular vaginitis and metritis of cattle, M. G. DE BRUIN (*Tijdschr. Veeartsenijk., 32* (*1905*), *No. 4, pp. 159-179, fig. 1*).—A historical statement is presented regarding the development of knowledge concerning this disease and the literature of the subject is critically reviewed. The characteristic symptoms of the disease are described with reference to making a differential diagnosis between it and similar diseases. The micro-organism found in cases of this disease usually appears as a diplococcus or streptococcus. Notes are given on the results obtained by the author and other investigators in applying antiseptic treatment. Considerable success may be expected from the application of creolin, lysol, bacillol, lysoform, nitrate of silver, ichthargan, and other antiseptics in 1 to 2½ per cent solutions.

Mammitis in cows, A. LANFRANCHI (*Clin. Vet.* [*Milan*], *28* (*1905*), *No. 10, pp. 49-57*).—A study of mammitis in cows led the author to the conclusion that in certain cases this disease may be due to *Micrococcus tetragenus septicus* or *M. tetragenus albus.* The symptoms and pathological anatomy of the disease vary somewhat according to the extent of infection and the micro-organism concerned in the case.

Specific arthritis of lambs (*Jour. Bd. Agr.* [*London*], *11* (*1905*), *No. 11, pp. 678-680*).—This disease is due to infection through the navel cord soon after birth. The best method of prevention consists in isolation of diseased lambs and a thorough application of antiseptic methods about the sheep quarters.

Navel ill or specific arthritis of lambs (*Bd. Agr. and Fisheries* [*London*], *Leaflet 130, pp. 3*).—A brief account of the etiology, symptoms, treatment, and means of prevention of this disease. Isolation of diseased lambs and disinfection of the premises are recommended.

Results of further experiment with nodule disease of the intestines of sheep. "Bare-lot" method of raising lambs, W. H. DALRYMPLE (*Louisiana Stas. Bul. 83, 2. ser., pp. 16, figs. 4*).—Lambs were allowed to run with the ewes in bare lots from which all vegetation had been removed. The ewes were fed by the soiling method. The lambs were kept with the ewes till they were ready to be fed for market. Water was supplied in a wooden trough.

In the experiment 9 ewes and 6 lambs were placed in one bare lot. Only 3 of the lambs became infested, and these so slightly that the lambs did not loose flesh or condition. The greatest number of *Œsophagostoma columbianum* found in any lamb was 3. All of the 9 ewes were infested with the worms at the beginning of the test. It is concluded, therefore, that it is possible by the bare-lot method to raise the lambs of ewes affected with nodule disease of the intestines without serious danger of infestation. The method is so simple that it may be used successfully by the average sheep man. It may be well, however, to use some effective vermifuge in connection with the bare-lot method.

Liver rot or fluke, A. A. BROWN (*Jour. Dept. Agr. Victoria, 3 (1905), No. 1, pp. 41-47, pls. 8*).—The appearance and life history of *Distomum hepaticum* and *D. lanceolatum* are described. Notes are given on the symptoms of liver rot, the pathological lesions, and methods of treatment. In order to keep down the development of snails, in which the early stages of the fluke worm are found, the use of lime and salt on wet grass lands is recommended. Tonics may be of some assistance in improving the condition of infested sheep, but little hope can be entertained of satisfactory results from medicinal treatment of this disease.

Fluke or slak in the liver of sheep, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 26 (1905), No. 1, pp. 33-48, pl. 1, figs. 17*).—The nature of this disease is discussed and notes are given on the life history of the fluke worm in its different hosts. Although there is no known effective treatment for liver fluke a change to uninfested pastures and attention to the nutrition and general health of the animals may have a favorable influence in a considerable percentage of cases. A brief account is given of the symptoms and post-mortem appearances of the disease.

Lungworm in sheep (*Agr. Jour. Cape Good Hope, 26 (1905), No. 5, pp. 666-669*).—The symptoms and post-mortem appearances of this disease are briefly described. A sheep raiser obtained excellent results from the use of McDougall's dip diluted at the rate of 1 to 60 and in doses of 3 tablespoonfuls. Isolation of affected animals is recommended, together with a supply of pure drinking water. Formulas are also presented for the preparation of a number of remedies to be used in the stomach and as intratracheal injections.

Contagious abortion in sheep and goats, E. THIERRY (*Jour. Agr. Prat., n. ser., 9 (1905), No. 10, pp. 304, 305*).—The symptoms of this disease are briefly described and notes are given on the usual means by which it becomes distributed and also on the means of controlling it.

The characterization of the hog cholera group of bacilli, H. SMIDT (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 1, pp. 24-30*).—A study was made of the bacilli of paratyphoid, mouse typhus, and hog cholera bacilli.

As a result of the author's investigations it appears to be impossible in individual cases to distinguish between these organisms either in respect to their morphology, cultural characters, agglutinating power, or pathogenic action. It was not possible to determine to what extent heredity in different races of bacilli modified the results obtained. The author is not prepared to state definitely the connection between hog cholera and paratyphoid of man, but believes that the subject is worthy of more study.

The problem of swine plague, SCHMIDT and R. OSTERTAG (*Berlin. Tierärztl. Wchnschr., 1905, No. 13, pp. 231-236*).—These articles are of a controversial nature and relate to the governmental measures which should be taken for the control of swine plague. It appears that in order that such regulations should be effective they must be established on a uniform basis throughout the German Empire.

Serum therapy and serum vaccination against swine erysipelas according to the method of Leclainche, A. DE MESTRAL (*Jour. Soc. Agr. Suisse Romande, 46 (1905), No. 2, pp. 59-63*).—The method proposed by Leclainche, when applied to healthy animals, is said to be absolutely harmless. It is not certain, however, whether pure serum may be injected with safety. The method of Leclainche is considered very effective in the control of swine erysipelas.

Vaccination for swine erysipelas and consequent complication with swine plague, GLAGE (*Fortschr. Vet. Hyg., 2 (1905), No. 12, pp. 305-319; 3 (1905), No. 1, pp. 3-11*).—According to the author's experience vaccination for swine erysipelas in animals which are affected with swine plague may be followed with serious consequences. It appears necessary, therefore, to make a careful diagnosis of the disease in order to be sure that swine plague is not present before applying the vaccination treatment.

An improved medium for cultivating Trypanosoma brucei, W. J. MACNEAL (*Rpt. Mich. Acad. Sci., 6 (1904), pp. 173–178*).—Up to the present time 114 successful culture trials have been made with this organism. Numerous changes had been made in the nutrient media before one was obtained in which the organism could be successfully cultivated. It appears that *T. brucei* requires a blood agar medium in the ratio of 2:1. Meat extractives must be present in considerable quantity. Common salt is not harmful when present in a not greater proportion than 5 gm. per liter. A detailed account is given of the method of preparing the nutrient medium.

The trypanosome problem, H. ZIEMANN (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), Nos. 3, pp. 307–314; 4, pp. 429–447*).—Descriptive and biological notes are given on various trypanosomes which affect domesticated and laboratory animals. The author discusses also the pathogenic action of various trypanosomes for sheep, goats, cattle, and horses.

Dourine, F. S. W. BALDREY (*Jour. Compar. Path. and Ther., 18 (1905), No. 1, pp. 1–22, figs. 9*).—The nomenclature, history, etiology, and symptoms of this disease are briefly outlined, with notes on the systematic position of the blood parasite. The incubation period after artificial inoculation is said to be from 7 to 10 days, and after natural infection from 12 to 20 days. Brief directions are given regarding suitable methods of studying the blood parasite in the laboratory. The author discusses also the preventive measures which are necessary in controlling the disease.

The virulence of a pasteurella in a horse affected with anasarca, COQUOT (*Bul. Soc. Cent. Méd. Vét., 82 (1905), No. 6, pp. 126–129*).—The symptoms and pathological anatomy of a case of anasarca in a horse are described in considerable detail. A pasteurella was isolated from this case which proved to be pathogenic for guinea pigs, producing lesions similar to those of hemorrhagic septicemia.

Botryomycosis in horses, P. CHAUSSÉE (*Rev. Gén. Méd. Vét., 5 (1905), No. 56, pp. 425–435, figs. 4*).—Notes are given on the clinical symptoms and pathological anatomy of this disease. According to the author's investigations it appears that botryomyces is made up of masses of botryococci which are eliminated during the process of suppuration. The tumors which are characteristic of this disease are diffuse and resemble in many respects those of actinomycosis, although more fibrous.

Subcutaneous botryomycosis in the horse, BIDAULT (*Rev. Gén. Méd. Vét., 5 (1905), No. 50, pp. 68–71*).—The lesions which occurred during the progress of this disease are described in considerable detail. A bacteriological study was made of material obtained from cases of the disease. Cultures were made on bouillon, gelatine, potatoes, carrots, etc. The cultures, as a rule, exhibit a white color and contain organisms resembling staphylococcus.

Transmission of glanders by a reacting horse apparently healthy, and reinfection of ceased reactors, A. CONTE (*Rev. Gén. Méd. Vét., 5 (1905), No. 52, pp. 199–203*).—A brief report is made on a case which demonstrates the possibility of the transmission of glanders by means of horses which show no clinical evidence of the disease but which merely react to mallein. It was also found, in making observations on 2 horses which thus became infected, that the disease may recur after an apparent recovery and after the animals have failed to react to mallein.

The sanitary control of glanders, V. GALTIER (*Jour. Méd. Vét. et Zootech., 56 (1905), Mar., pp. 129–138*).—In controlling glanders it is considered necessary that all cases or suspected cases of glanders be immediately reported, and that the diseased animals be destroyed and proper measures taken for quarantining exposed animals and protecting healthy animals from infection with the disease.

Biliary fever in the horse, A. EDINGTON (*Jour. Compar. Path. and Ther., 18 (1905), No. 1, pp. 35–40*).—This disease was studied in Cape Colony in cases of spontaneous origin and after artificial inoculation. The disease can be readily transmitted by the latter method. Animals which come from the coast region appear to be somewhat refractory. In a series of 50 horses upon which inoculation experi-

ments were made, 16 proved insusceptible, 27 developed fever and were subsequently insusceptible, while 2 showed no fever even after the second inoculation. The author believes that one attack renders the animal immune.

The so-called maxillary disease of horses and mules in Kamerun, H. ZIEMANN (*Arch. Wiss. u. Prakt. Tierheilk.*, *31* (*1905*), *No. 3*, *pp. 300–311, figs. 3*).—This disease is described in great detail. The temperature of affected animals appeared not to be greatly affected. In most cases the result was fatal after the disease had run a course of from 4 to 12 months. The most pronounced lesion was in the maxillary bones and soft tissues of the face. The etiology of the disease was not definitely determined. From unsatisfactory inoculation experiments it appeared that if the disease was of a bacterial nature the incubation period was of about 50 days.

Tetanus and antitetanic serum, W. H. DALRYMPLE (*Vet. Rec.*, *17* (*1905*), *No. 867*, *pp. 513–516*).—A record is given of 9 cases of tetanus in horses treated by the author, with recovery in 7 cases, and a similar recovery of 15 out of 28 cases which occurred in the practice of a colleague of the author. It is argued that since the difficulty of obtaining perfect asepsis in deep wounds is very great, the desirability of using antitetanic serum is sufficiently apparent.

The virulence of the blood in rabid animals, A. MARIE (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 12*, *pp. 544, 545*).—Mice inoculated hypodermically with the defibrinated blood of rabid guinea pigs and a rabbit inoculated in the brain with the blood serum of another rabbit which had died of rabies developed rabies in a virulent form. These positive results from inoculation are supposed to indicate the presence of virus in the blood.

Is rabies hereditary? D. KONRÁDI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig.*, *38* (*1905*), *No. 1*, *pp. 60–66*).—Attention is called briefly to results thus far obtained in a study of the hereditary transmission of various infectious diseases. This question was tested by the author with regard to rabies, the experimental animals being rabbits and guinea pigs. It appears from these experiments that rabies virus may be transmitted from the mother to the fetus, but that the virus becomes somewhat attenuated during this transmission. It is recommended that in such experiments both rabbits and guinea pigs be used, and that observations be extended over a period of about 1½ years.

RURAL ENGINEERING.

Report of irrigation and drainage investigations, 1904, E. MEAD (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904*, *pp. 425–472, pls. 5, figs. 5*).—A leading feature of the irrigation work from the beginning has been the measurement of the quantities of water used in irrigation. This has served to bring to the attention of water users the possibility of extending their irrigated area by economy in the use of water.

One canal in California diverts sufficient water to cover the land irrigated to a depth of more than 13 ft., while the water diverted by another would cover the land irrigated to a depth of less than 2 ft. The first season's measurements on the Sunnyside Canal in Washington showed sufficient water to cover the land to a depth of 10 ft., while the measurements in 1904 showed a reduction to 6 ft., and there is thought to be still room for great improvement.

In 1904 these measurements were supplemented by experiments on the water requirements of crops, the application of water at different stages in the growth of the crops, to determine the influence on the yield and quality of the product, and means of checking the loss of water from the fields. Taking the quantity of water evaporated under surface flooding as a basis, applying water in shallow furrows made a saving of 13 per cent and in deep furrows a saving of 25 per cent.

As to the adaptability of different methods of irrigation, checking was found advantageous for light sandy soils which are approximately level. With this method an irrigator can handle a large volume of water, reducing the cost of applying water to a minimum. It requires, however, much preliminary preparation in making

levees and in leveling. Flooding was found best adapted to irrigation of grains and grasses. It requires little preliminary preparation, but large amounts of labor in applying the water to the fields. Furrow irrigation is used for orchards and cultivated crops. The losses of water by evaporation are smaller, and small streams can be used to better advantage than under the other methods.

The data collected regarding cost of preparing land for irrigation show that the removing of sagebrush, leveling and smoothing the land, and the construction of laterals varies from \$3.50 to \$35 per acre.

A large part of the arid region can not be supplied with water from streams, and during 1904 the possibilities of supplying this section by means of pumps was investigated. The average cost of windmills per acre irrigated was found to be \$42, and the annual cost of maintenance, \$2.35 per acre. Computing interest on the investment at 7 per cent and depreciation at 10 per cent, the annual cost for windmill irrigation amounts to an average of \$9.49 per acre. This is a heavy charge, and when considerable areas are to be irrigated some other kind of power will be found cheaper.

Information was collected from a large number of localities as to the cost of pumping plants and of their operation. The plants examined showed the following average fuel cost per acre-foot of water raised 1 ft. for the pumps of different sizes: All sizes, 3 cents; less than 1 cu. ft. per second, 9.4 cents; 1 and less than 5 cu. ft. per second, 4.9 cents; 5 and less than 10, 2.5 cents; 10 or more, 2.3 cents. This brings out the great economy in fuel cost of using large plants. The saving in cost of attendance is even greater than in fuel. Laboratory tests of typical pumps showed the great importance of having the pump proportioned to the work to be done. Each pump works most efficiently at a particular speed and with a fixed lift, and these matters should be taken into consideration when the pump is purchased.

Measurements of the water used in rice irrigation, carried on for 4 years, showed a tendency to use less water. It was found that when water is maintained at too great a depth on the rice fields the soil is not sufficiently warmed to produce the best results. During low water in the streams along the Gulf Coast, salt water sometimes sets in from the Gulf and it was feared that the use of this water might, in addition to injuring the crop to which it was applied, permanently injure the land, but so far no such permanent injury has taken place. The rains of winter and the irrigation with fresh water have washed out the salt, leaving the land in good condition.

The drainage work summarized in this report includes the drainage of the lands injured by seepage water and alkali in the arid region, the drainage of large areas of bottom land through the Middle West, the protection of river-bottom lands by levees and the drainage of lands within the levees, the drainage of farm lands, and the protection of hillsides from erosion by the use of underground drains.

The most serious defects in levees for protecting the bottom lands are found to be insufficient preparation of the land on which the levees are to rest, thus allowing water to seep under the levees; and insufficient care in maintaining the levees, so that when floods come weak places are found.

A list of the publications issued during the year 1904 is given.

Disposal of household wastes at summer resorts, encampments, and farm houses. Pure water supply and other sanitary conditions, R. FLETCHER (*N. H. Sanit. Bul., 1905, July, Sup., pp. 23, figs. 8*).—This paper, prepared for the New Hampshire State Board of Health, treats this subject with reference to a pure water supply and other sanitary conditions.

It deals with intolerable means of disposal; methods and appliances for disposal of wastes, including fecal matter, kitchen and chamber slops, and other liquid sewage and garbage; the construction of wells and their protection from contamination. The septic tank method of sewage disposal receives special attention. Farmers' Bulletin 43 of this Department is one of the principal sources from which the paper is compiled.

Better roads for Missouri (*Mo. Bd. Agr. Mo. Bul., 5 (1905,) No. 2, pp. 30, figs. 10*).—A fourth revised edition of this bulletin, dealing mainly with road dragging by the King method (E. S. R., 15, p. 415).

Industrial and agricultural development in Europe and America, A. CHATTERTON (*Madras: Rev. Dept., 1905, pp. 36*).—This report to the Madras Government contains the information bearing on various lines of agriculture, obtained during an extended trip through Europe and the United States.

Much statistical matter is given on the extent of irrigation, the cost and value of water obtained by pumping for irrigation, the use of electric power and of gasoline and steam for pumping, the size and location of wells, the use of centrifugal pumps, the use of the windmill, and the development of power for general farm purposes.

Hydraulic engines at the U. S. Naval coaling station, Bradford, R. I. (*Engin. News, 54 (1905), No. 5, pp. 127, 128, figs. 2*).—This is an illustrated description of a pair of unusually large hydraulic rams recently built, which show a very high efficiency according to the following results of tests made by engineers of the Navy Department:

	No. 1.	No. 2.
Total water delivered to engine, gallons per minute	582	578
Water delivered to standpipe, gallons per minute	232	228
Power head in engines, feet	36.75	37.25
Pumping head, in feet, at engines	84.0	84.0
Strokes per minute	130	130
Efficiency, per cent (Rankine formula)	85.2	81.9

AGRICULTURAL EDUCATION.

Progress in agricultural education, 1904, A. C. TRUE (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 575–616, pls. 5, figs. 6*).—A review is given in this article of the leading features of progress in agricultural education, including the general educational work of this Department, the educational work of this Office in relation to both American and foreign institutions, that of the Association of American Agricultural Colleges and Experiment Stations, and of the different agricultural colleges, secondary schools, and primary schools throughout the country.

The article devotes considerable attention to the development of courses of study, especially courses in rural engineering and rural economics and sociology, including an outline for a proposed course in rural sociology by K. L. Butterfield. A report on The Teaching of Agriculture in the Rural Common Schools, presented by the standing committee on methods of teaching agriculture at the last convention of the Association of American Agricultural Colleges and Experiment Stations, is also included.

Exhibits at the Louisiana Purchase Exposition, W. H. EVANS and W. H. BEAL (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 687–714, pls. 8*).—Included in this article are brief descriptions of the exhibit of this Office in the Government Building, and that of the colleges of agriculture and mechanic arts and experiment stations in the Palace of Education at the Louisiana Purchase Exposition.

Annual report of farmers' institutes, 1904, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 617–675*).—This report includes a brief review of the work of the farmers' institute specialist for 1904; an account of the annual meeting of the American Association of Farmers' Institute Workers at St. Louis; a discussion of the progress and needs of the institutes, with suggestions regarding normal schools for institute workers and further aid to the institutes by this Department, and detailed reports on farmers' institutes in the different States and Territories.

Report of the extension work of the college, A. E. STENE (*Bul. R. I. Col. Agr. and Mech. Arts, 1 (1905), No. 2, pp. 21, pls. 3, dgm. 1*).—This report contains a discussion of the aims of college extension in agriculture and an outline of work of this

nature at the Rhode Island College, including demonstration work and cooperative experiments, the service of traveling lecturers, and the nature study and school garden work. The report also contains an article on Some Special Phases of the Extension Work, by F. W. Card; one on The Poultry Library, a discussion of literature bearing on poultry culture, by Cooper Curtice, and Notes on Correspondence, by H. J. Wheeler.

Agriculture at Purdue University, W. E. STONE (*Indiana Sta. Bul. 107, pp. 12*).—A description of the facilities for teaching agriculture at Purdue University is given, together with syllabi of the four-year course, the two-year course and several special courses; brief notes regarding farmers' institutes and reading circles, and a brief account of the agricultural investigations conducted by the experiment station.

County schools of agriculture in Wisconsin, K. C. DAVIS (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 677–686, pls. 4*).—The author describes the equipment of the county schools of agriculture located at Menomonie and Wausau, Wis., and discusses the character and methods of instruction, the attitude of students, and the popular and correlative work of the schools.

Elements of agriculture, J. H. SHEPPERD and J. C. MCDOWELL (*St. Paul, Minn.: Webb Pub. Co. [1905], pp. 254, figs. 79*).—This text-book of elementary agriculture was prepared especially for the common schools of North Dakota in which agriculture is now a required subject of instruction.

The arrangement of topics in the text-book is somewhat unusual, but this seemed to be necessary in order that the course of study might follow the seasons, the work on farm crops coming in the fall, that on domestic animals in the winter, and that on soils and the beautifying of home and school grounds in the spring. In addition to the work mentioned above there are chapters on weeds, injurious insects, birds, fruit culture, the care of farm machinery, roads, corn-growing contest, and legal weights. Numerous exercises for the illumination of the different subjects are outlined.

Course of study for the common and graded schools of North Dakota (*Bismarck, N. Dak.: Dept. Pub. Instr., 1904, pp. 176, figs. 17*).—Among the subjects outlined in this course of study are nature study and agriculture. The nature study work extends over the first 6 years of the common school course and has a decided agricultural trend, especially in the fifth and sixth years. The work in elementary agriculture is intended for the seventh year and includes studies of farm crops, weeds, plant diseases, injurious and beneficial insects, live stock, dairying, the improvement of home and school grounds, the garden, birds, forestry, roads, and soils.

Program of studies for the common schools of New Hampshire (*Concord, N. H.: Dept. Pub. Instr., 1905, pp. 157*).—This program of studies was prepared under the direction of the State superintendent of public instruction, and contains outlines and detailed instructions for presenting the various subjects of instruction. Among these subjects are nature study and agriculture.

The nature study program extends over 4 years, and includes a discussion of methods and detailed suggestions for conducting the work by years and months. Elementary agriculture is to be taught in the grammar school (fifth to eighth years, inclusive), and is outlined by years and school terms. The first year is devoted to soils, their composition, formation, cultivation, exhaustion, improvement, etc.; the second year to plant production, including propagation, cultivation, enemies, diseases, etc., of the principal fruits, forest trees, farm crops, garden vegetables, and ornamentals used in decorating home grounds.

The third year farm animals and poultry are taken up; and the fourth year farm manufactures and domestic economy. Farm manufacturers include milk, sugar, dried and canned fruits and vegetables, soap, honey, etc.; and domestic economy the care and handling of milk in the home, sewing, canning and preserving fruits, washing delicate-colored goods, cooking, home sanitation, and other related subjects.

Nature-study lessons for primary grades, LIDA B. MCMURRAY, with an introduction by C. A. MCMURRAY (*New York: The Macmillan Co., 1905, pp. 191*).—This is a teachers' manual, consisting of a series of nature-study lessons which were worked out by the author in the class room and in outdoor excursions with children. The book is divided into two parts—(1) animal life, containing lessons on pets, domestic animals and fowls and common birds and insects, and (2) plant life, with lessons on flowers, trees, buds, leaves, and fruit. The lessons consist of stories intended to arouse an interest in plant and animal life on the part of the children, and suggestive questions for the teacher.

The author holds that "a teacher in nature study must know how to live happily and companionably with children among the birds, flowers, insects, and trees," and "how to enjoy an excursion with children." Furthermore, "one must learn to concentrate the children's thoughts along given lines, for a mere chasing after chance birds and butterflies will not answer. Having awakened the attention and interest of children in certain lines, it is necessary to lead on to more definite observations, and, sooner or later, to get from the children a clear statement of facts."

MISCELLANEOUS.

Annual report of the Office of Experiment Stations, 1904 (*U. S. Dept. Agr., Office Expt. Stas. Rpt. 1904, pp. 724, pls. 42, figs. 11*).—This contains the usual report on the work and expenditures of the agricultural experiment stations in the United States; annual reports of the experiment stations in Alaska, Hawaii, and Porto Rico; reviews of irrigation and nutrition investigations, and several other articles abstracted elsewhere in this issue.

Included in the report on the work and expenditures of the stations are statistical summaries; brief reports of nutrition and irrigation investigations; a summarized account of the meeting of the Association of American Agricultural Colleges and Experiment Stations; a review of the work of this Office; a report on the governing board, station staff, general outlook, lines of work, income, and publications of each experiment station; a list of station publications received by this Office during 1904; federal legislation, regulations, and rulings affecting agricultural colleges and experiment stations, etc.

Seventeenth Annual Report of Louisiana Stations, 1904 (*Louisiana Stas. Rpt. 1904, pp. 16*).—This contains statements on the condition of crops at the Louisiana stations, outlines of work conducted during the year, organization lists, and a financial statement for the fiscal year ended June 30, 1904.

The work at the substations, L. R. TAFT and C. D. SMITH (*Michigan Sta. Bul. 226, pp. 149–164, figs. 6*).—This is a review of the reports of the South Haven and Upper Peninsula substations for 1903 and 1904, published as Special Bulletins 27, 28, 30, and 31 of the station (E. S. R., 16, pp. 250, 260, 261; 17, pp. 22, 35, 37).

Annual Report of New Jersey Stations, 1904 (*New Jersey Stas. Rpt. 1904, pp. XIX+652*).—This includes the organization lists of the stations; a financial statement of the State station for the year ended October 31, 1904, and of the college station for the fiscal year ended June 30, 1904; a report of the director reviewing the different lines of station work; and reports of the chemists, soil chemist and bacteriologist, horticulturist, dairy husbandman, biologist, botanist, and entomologist, abstracted elsewhere. Included in the report of the chemists are reprints of Bulletins 175 of the station on concentrated feeding stuffs (E. S. R., 16, p. 394), and 183 on agricultural lime (E. S. R., 17, p. 18).

Experiment Station Work, XXX (*U. S. Dept. Agr., Farmers' Bul. 227, pp. 32, figs. 2*).—This number contains articles on the following subjects: Top-dressing grass land, extension of the corn-growing area, culture of peanuts for forage, winterkilling of fruit trees, cranberry culture, lime-sulphur-salt wash, destroying prairie dogs, clean milk, and construction and ventilation of poultry houses.

NOTES.

Florida University and Station.—P. H. Rolfs, at present in charge of the Subtropical Laboratory of this Department at Miami, and formerly connected with the university and station, has been elected director of the station. He will also succeed F. M. Rolfs, resigned, as horticulturist in the university and station. He will enter upon his duties some time in January.

Kansas College and Station.—The contracts have been let for the new Horticultural Hall, appropriation for which was made by the last legislature. The basement and first floor will be used by the horticultural department and the second floor by the botanical department. The building will cost something over $35,000, and new greenhouses costing $10,000 will be constructed later. The contract calls for the completion of the building by September 1, 1906.

Maine University and Station.—G. E. Tower, who was erroneously mentioned in a previous issue as professor of chemistry, is in charge of the department of forestry in the university. The station is just completing the erection of an incubator house. The building is one story, with basement, and is 31 ft. square. The high, well-lighted basement will be used for an incubator room, and the upper story and attic as a tenement for the poultryman.

Maryland Station.—C. W. Nash, a graduate of the Iowa State College in the class of 1905, has succeeded E. P. Walls, resigned, as assistant agronomist.

Massachusetts College and Station.—The large college barn erected in 1893 was totally destroyed by fire on the night of November 16, together with the greater part of its contents. The latter included about 300 tons of hay, a large amount of silage, a carload of grain feed, 600 bu. of potatoes, large quantities of other root crops, and several thousand dollars worth of farm implements and machinery, among which was the apparatus used in the dairy school. This was entirely destroyed. Considerable live stock, including about 20 head of young cattle, 3 cows, 4 bulls, a prize ram, and nearly 60 head of swine, was also lost. The origin of the fire, which started in the hay, is unknown, but there are said to be good grounds for believing it was incendiary. The building was lighted by electricity, which was the only light used about the building, but there were no electric wires in the part where the fire apparently started.

The original cost of the barn and its equipment was about $45,000, and the value of the property destroyed is estimated at more than $15,000. The rooms for the dairy school had been fitted up in recent years, and the loss of machinery and apparatus will seriously handicap that department. Arrangements have been made to fit up rooms in the basement of a dormitory building for the dairy school, which will open in January. A part of the live stock has been sold at auction owing to lack of accommodations for it. The State had of late followed the plan of insuring its own property, so that a considerable part of the insurance formerly carried had been allowed to lapse. From the unexpired policies $17,229 will be allowed by the insurance companies on the barn and its contents. The legislature will be asked for an appropriation to rebuild the barn, probably using a more permanent style of construction, such as concrete or cement throughout for the stables.

Rutgers College.—Dr. Austin Scott has resigned the presidency of the college, owing to the condition of his health, but will retain the chair of history and political science.

Cornell University and Station.—A course of lectures on agricultural journalism will be delivered at the college during the winter, probably at the time the short courses are in session. R. C. Lawry has been appointed assistant in poultry husbandry. The dairy department has leased the Sage creamery, situated about six miles north of Ithaca. This was done to secure a continuous supply of milk for instruction and experimental work in the winter. In the summer the place will be run as a skimming station.

Oklahoma College and Station.—The contract has been let for the new agricultural building, work upon which will be begun at once. The building will be 166 ft. long by 76 ft. wide, and consist of a basement of full height and entirely above ground, with two stories above and an attic. The basement, or first story, will be of white limestone and the rest of red pressed brick. The general style will be colonial. Mill construction will be followed, with the main partitions of brick and extending from the basement to the roof. The building will be heated from a central heating plant by indirect radiation, the flues being built into the walls. Provision will be made for the work in animal husbandry, agronomy, farm mechanics, and agricultural physics, of both the college and the station, and the agricultural chemistry work of the station. There will be administrative offices for both the college and the station officers, and in the basement will be located a large stock-judging room and rooms for agricultural machinery. The cost of the building will be about $64,000, exclusive of equipment.

Tennessee Station.—By an agreement between the station and a local poultry publishing company it has been possible to establish a poultry department in the station. The station will furnish the necessary land and feed for the poultry, and the local company will erect the buildings and give the services of an expert poultryman. J. H. Sledd, editor and manager of *The Industrious Hen*, will be in charge of the department and will also lecture on poultry in the short course at the university.

Adams Bill in Congress.—Hon. H. C. Adams reintroduced his bill for the increase of the appropriation to the experiment stations on the opening day of Congress, and it was referred to the Committee on Agriculture. As is generally known, the bill provides for an increase of $5,000 the year that it becomes a law, and an additional increase of $2,000 each year for five years, making the ultimate appropriation under the bill $15,000 in addition to the Hatch Fund.

Smith Agricultural School.—Reference has previously been made to this school, the fund for which was bequeathed by Oliver Smith, of Hatfield, Mass., sixty years ago. The original amount of the bequest was $30,000, which has increased until it now amounts to over $300,000. The fund will become available December 22 of this year, and in order to prepare for the establishment of the school the trustees have purchased a tract of 93 acres of land near Northampton, Mass., at a cost of $19,450. The provisions of the will are sufficiently liberal to allow the trustees to exercise wide discretion in planning the school and mapping out its work. It is understood that training in mechanic arts, as well as in agriculture, will be included.

The Royal Agricultural College.—The curriculum of the Royal Agricultural College, at Cirencester, has recently been extended in two important particulars, according to a note in *Mark Lane Express*. A two-year course of lectures and demonstrations in poultry and poultry keeping has been provided. The lectures will cover the whole field of scientific poultry farming, and the students as they become qualified will have charge of the fowls, incubators, etc., under supervision. There will be an examination for certificates at the end of the course. The other departure is the establishment of "postgraduate dairy classes." Students who have taken the college diploma will have the opportunity of attending the vacation dairy classes without payment of any fee, i. e., during three weeks in the spring vacation and four weeks in the summer vacation. Students attending these classes will be expected to perform the manual operations of butter and cheese making, under supervision, and to qualify by examination for the special certificate of the college in dairying.

Agricultural Education in Roumania.—The institutions giving instruction in agriculture in Roumania, according to an article in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, for October 28, 1905, are mostly included under 4 heads: (1) Seven elementary agricultural schools offering 2-year courses, (2) 6 secondary agricultural schools offering 3-year courses, (3) 2 model State farms, and (4) the Central Agricultural School, near Bukharest, which stands at the head of the system. The present attendance at the Central Agricultural School is 166. The course of study includes instruction in animal industry, sericulture, and apiculture, and extends over 4 years, 1½ years of which are spent on the model State farms, located respectively at Laza and Studina. There are also special schools for instruction in dairying, horticulture, mulberry growing, phylloxera extermination, and domestic science, the latter connected with the secondary school at Armasesti.

Experiment Farms in Natal.—The principal experiment farm in Natal is the Central Experiment Farm, established in 1902, at Cedara, 8½ miles northwest of Pietermaritzburg. This farm contains 3,614 acres, upon which 1,493 experiment plats have been in operation during the past year. There have also been 1,174 variety tests of field crops, and 140 acres devoted to experimental orchards. A dairy herd is being developed, and it is proposed to establish schools of agriculture on the farm for both young men and young women.

At Winkle Spruit a 500-acre farm was acquired in 1904, and has been devoted to special problems relating to coast agriculture and the cultivation and preparation of semitropical products, especially sugar cane and cotton. A farm of 59 acres at the Weenen Irrigation Settlement, and another at Stanger, on the North Coast, have been started this year.

International Institute of Agriculture.—In an article in the current number of the *Fortnightly Review*, noted through *Nature*, the Marchese Raffaele Cappelli sketches the growth of the ideas which led to the recent international conference on agriculture, held at Rome last spring. He enumerates also the advantages likely to accrue from the International Institute of Agriculture created on that occasion. "At the close of the conference referred to, a protocol was signed by the representatives of all the governments of the world—with the exception of some minor ones—favoring the establishment of the International Institute, and asking the respective governments to adhere to the same. In the opinion of the writer of the article, the institute must aim at regularizing, promoting, and generalizing its internationalism. It must provide for the rapid and general diffusion of knowledge of technical improvements in the economics of production. The institute must further undertake the task of coordinating the efforts of many cooperatives scattered throughout the world, so that they may act in harmonious agreement. But most important of all will be the services which the international corporation will be able to render in the field of the economics of distribution."

Association of Farmers' Institute Workers.—The American Association of Farmers' Institute Workers met at Washington, November 9–11. The meeting was attended by about a hundred delegates and visitors, and was regarded as a success from both a business and social standpoint. The sessions were presided over by Prof. E. A. Burnett, vice-president, in the absence of President J. C. Hardy. The association was welcomed by the Secretary of Agriculture, and papers on consolidated public schools and on movable agricultural schools were read by Assistant Secretary W. M. Hays and Prof. John Hamilton, of this Department. There were also papers on institute organization and methods, cooperation with other educational agencies and with the National Department of Agriculture, and upon boys' and girls' institutes. There was a mild protest against the consumption of so much time by reports from the several States and Provinces, and it was decided to limit this feature in future to one session.

The officers elected for the ensuing year are: President, G. C. Creelman, of Guelph, Ontario; vice-president, W. W. Miller, of Ohio; secretary-treasurer, John Hamilton,

Department of Agriculture; executive committee, the president and secretary-treasurer (ex officio), J. G. Lee of Louisiana, F. H. Hall of Illinois, and W. L. Amoss of Maryland.

Children's Gardens in New York City.—The children's farm school, inaugurated in 1902 by Mrs. Henry Parsons on the site of the proposed DeWitt Clinton Park, has now been incorporated as a permanent feature in the completed park. A definite area has been set apart for gardens, and adjacent to this, in the basement of a brick pergola, are school rooms, some of which are furnished for domestic science work, which is a feature of instruction required of girls who raise vegetables in the gardens. During the past season 2,500 children took part in the garden work and raised about 90,000 vegetables of different sorts.

Personal Mention.—Dr. Alonzo D. Melvin, assistant chief of the Bureau of Animal Industry, has been appointed chief of the Bureau, vice Dr. D. E. Salmon, resigned.

Among the honors conferred on the occasion of King Edward's birthday was that of commander of the Order of St. Michael and St. George upon Dr. William Saunders, director of the Central Experimental Farm, at Ottawa, Canada.

Director L. H. Bailey, of Cornell, will deliver one of the lectures in the series on Educational Problems, provided by the department of education of the City of New York.

Charles Robert Wynn-Carrington has been appointed president of the board of agriculture in the new British cabinet.

The death is announced of Prof. Th. Freiherr von der Goltz, director of the Agricultural Academy at Poppelsdorf and professor of political economy in the University of Bonn. He was a well-known writer upon agricultural topics, especially in the field of farm management, agricultural taxation, and the history of agriculture.

Miscellaneous.—A regulation recently issued by this Department directs that packages containing parasites of the gypsy and brown-tail moths, or parasitized specimens of these moths, when addressed to A. H. Kirkland, the superintendent for suppressing the gypsy and brown-tail moths, Boston, Mass., may be shipped from any European country into the United States, entry to be made through the ports of Boston or New York.

The Proceedings of the Eighth Annual Session of the Texas Farmers' Congress, a volume of nearly 300 pages, have been received. This congress was held at the Texas Agricultural and Mechanical College, July 25–27 last, and was attended by about 2,500 farmers. Meetings of 13 State agricultural and horticultural associations were held during the congress, and the minutes of each of these, with the more important papers, are included in the proceedings.

The Ohio State University has begun the publication of a series of agricultural college extension bulletins. Vol. 1, No. 1, of this series which was issued in October, 1905, contains an article on The Life of a Moth, by F. M. Webster, and one on Planting on Rural School Grounds, by A. B. Graham.

The Department of Agriculture and Technical Instruction for Ireland has established a seed-testing station at its laboratories in Dublin, which, in addition to making purity and germination tests for farmers, offers to identify plants and plant diseases free of charge.

Fermes et Châteaux is a new French publication, the first number of which was issued in September. It is similar in plan to *Country Life in America* and the *Country Calendar*, and is intended to occupy the same place in French agriculture that these publications do in American agriculture.

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EXPERIMENT STATION RECORD.

Vol. XVII. January, 1906. No. 5.

The International Live Stock Exposition at Chicago has become the leading live stock event of the year. As such it is of interest not only from the showman's point of view, but in its bearings upon the improvement of the live stock of the country and as a great educational factor. The exposition of 1905, the sixth to be held, surpassed all previous ones both in the number of entries in the various classes and in the general excellence of the animals shown. The attendance also broke all former records and taxed the capacity of the new amphitheater to the utmost.

This new building, which was only barely completed in time for the exposition, added greatly to the attractiveness of the exposition and to the comfort of the judges, the spectators, and the animals. The pavilion is fireproof, being built of iron, brick, and concrete. It is 600 feet long by 310 feet wide, 60 feet high in the walls, and is covered with a roof quite largely of glass. It is heated by steam, so as to be comfortable at all times. The roof is supported by iron trusses and hence there are no posts in the building to obstruct the view.

In the center of the amphitheater is a tan-bark arena, occupying a space 236 feet long by 100 feet wide. It was sufficient for showing three or even four classes of stock at a time without confusion, and furnished a splendid ring for the display of horses in harness and in saddle, and six-horse draft teams. The maneuvering of five of these six-horse teams at a time in this great arena, with the display of some excellent fancy driving, was one of the spectacular features of the show. A wide passageway surrounds the arena, and from this rise the boxes and tiers of seats, estimated to accommodate from eight to ten thousand people. These afforded a splendid view of the animals in the arena and the work of the judges.

In spite of the size of the building, it could not begin to accommodate the crowds, especially at night, and it is understood that it is to be enlarged before another year. The turnstiles showed an attendance of from thirty to forty thousand people a day, and the total estimated for the week exceeds six hundred thousand admissions.

The catalogue of the exposition contained ten hundred and fifty-five entries of cattle, eight hundred and fifty-seven of sheep, two

hundred and fifteen of hogs (barrows), and six hundred and seventy-nine of horses. This was aside from the entries for prizes offered by the breeding associations and other specials, and does not include the carload lots shown in the yards, which nearly doubled the number of cattle. The number of entries in some of the classes was exceptionally large and the competition very sharp. So even were the individuals in some classes that the finest discrimination of the judges was called for, slight differences determining the prize winners.

The cattle were stabled in wings adjoining the arena, and the horses, sheep, and swine in nearby buildings. The accommodations for the stock were comfortable, and reduced the element of danger from exposure to a minimum. The excellent provision made for the conduct of this exposition and the comfort of the visitors, together with the apparent smoothness which characterized the events of the week, reflects great credit upon the management and the officials in charge of the various departments.

The importance of this great show as an educational event is coming to be more appreciated every year. It brings together the finest specimens of horses, cattle, sheep, and certain classes of swine, representing many types and breeds, to compete for prizes offered by the exposition and the breeders' associations. Such an aggregation is not to be seen anywhere else in the country, perhaps in the world. Naturally a large number of representative breeders and stockmen of the country attend the show to compare notes with their colleagues and competitors, and to keep track of developments in their lines, as well as for business purposes. But what is quite as important, the show now attracts thousands of farmers and stockmen from all over the country, who go there to learn and to have their ideals developed. This perhaps constitutes its greatest value and influence. There is no question that it has stimulated interest in better stock, and already raised the standard of many farmers and stockmen. The result is felt in a larger demand for thoroughbred animals for breeding purposes, and in closer and more intelligent discrimination in buying grades and crosses.

A man must first know and be able to appreciate the good points of an animal, and to weigh their relative value in determining excellence, before he can be in position to improve the stock which he keeps or breeds. Such a display of animals as is presented for his inspection in the show ring, and judged by experts before his eyes, is an incomparable opportunity for studying types and degrees of excellence as determined by the judges. Add to this the chance to inspect the animals leisurely at close range in the stables, to learn their breeding and records, and to meet with some of the leading breeders and importers of stock, and the advantages of this show to the practical stockman

will be fully apparent. To the man of fine discrimination, the exhibition in the immense arena is a genuine treat and an inspiring spectacle from start to finish.

The farmers and stockmen were in attendance this year in full force, from Canada and from Texas, throughout the Middle and Central West, and many from the far West. They followed the work of the judges with close interest and were evidently there to see and to learn. Their presence in such numbers and their attitude was an illustration of the interest the show has aroused and of its educational possibilities.

But the educational advantages of this great animal show are not confined to the actual stockmen and breeders of the country by any means. They are equally apparent in the case of the embryo experts—the students of the agricultural colleges. For them no such opportunity presents itself elsewhere. At the college they see a few specimens of the principal breeds of their section, necessarily very limited in number and sometimes also in quality. They make a few trips perhaps to some breeding farms and fairs where they have opportunity to examine and compare the animals. But what is this in comparison with the opportunity to see a score or more of the choicest specimens of a class in the ring at once, to have such a succession of breeds and types presented, to go through the stables under the guidance of an instructor and have the points of excellence of animals by the hundreds explained to them?

It is interesting to follow a party of these students. They are interested, anxious to keep close to the instructor, to get their hands on the animal, and to hear about its record and special merits. They have not come to the show merely for a lark. The attendants in charge of the stock know the professors and bring their prize animals out for a better view; and the boys have a lesson in type, conformation, and qualities that is worth weeks at the college, and will be often referred to in the class room. It is a splendid experience.

That this is appreciated was evidenced by the large bodies of students in attendance upon this year's show. Seventeen States and the Province of Ontario sent delegations in varying numbers. There were about a hundred each from Illinois, Iowa and Nebraska, large numbers from the colleges nearer by, like Wisconsin, Michigan, Indiana and Ohio, thirty from Colorado, ten from Texas, several from Kansas, Missouri and Louisiana, and eighteen from Ontario. These bodies of students were a notable element in the crowd. They made their presence evident, and their banners and emblems called attention to their respective colleges.

The opening day was given up to the competitive student judging. It will be recalled that there are two trophies in this competition, offered by the exposition company—one for horses, and the other for

cattle, sheep, and swine. Teams of five students each from the Ohio, Iowa, Michigan, Kansas, Missouri, Texas, and Ontario agricultural colleges took part in this competition, which was in charge of Prof. W. J. Black, the president of the new Manitoba Agricultural College. The utmost fairness characterized the contest. A somewhat different method was followed this year than in past years, the boys appearing singly before the judges after they had completed their work, and giving the reasons for the order in which they had placed the animals, instead of presenting papers to be marked subsequently. While this was something of an ordeal for the boys it enabled the result to be known within a day or two.

The horse-judging trophy, held by Iowa, was won this year by the Ohio team; and the one for cattle, sheep and swine, held by Ohio, went to the Ontario team. The Ohio boys led in work with cattle as well as horses, Texas on swine, and Ontario on sheep. The latter, however, scored the largest combined number of points in judging cattle, sheep and swine, with Iowa second. The corn-judging team from Iowa won the Cook bronze trophy, held by the Kansas Agricultural College, Nebraska ranking second, and Kansas third.

The spirit of good-natured rivalry which this competition engenders is a healthy one and is something of a stimulus to both students and instructors in their work. Considerable college spirit is developed, and the opportunity to measure swords with another institution is helpful to the boys and those responsible for their instruction. The experience of taking part in such a contest is a valuable one, helping to develop confidence, self-reliance, and decision.

Properly managed, the students' judging contest becomes an attractive and valuable feature of this show. Incidentally it attracts considerable attention to the colleges and to the practical nature of their work.

The agricultural colleges and experiment stations were a notable feature of the show, aside from the student representation. The official catalogue showed no less than two hundred and seventy-five entries by them in ninety-five different classes. While some animals were of course entered in more than a single class, this summary indicates the wide range covered by their exhibits. The entries were largely in the fat stock, sheep and swine classes, although there were several in the breeding classes and among the horses. Iowa, Michigan, Nebraska, and Cornell University also showed in the dressed carcass classes for cattle, Wisconsin in those for sheep, and Iowa, Cornell and Ohio in those for swine. Seventy-three of the entries mentioned above were in the college and station specials, seventy being in those provided through the generosity of Clay, Robinson & Co.

The grand championship of the fat stock show was won by the Iowa State College, with an Angus steer selected by Prof. C. F.

Curtiss about a year ago from a carload lot at the stockyards, and fed at the college. The reserve champion was also from the college, a quite remarkable fact. This is the fourth year that the grand championship has fallen upon a college or station animal. In 1902 it went to Iowa, in 1903 to Nebraska, and in 1904 to Minnesota. The showing made by the colleges in the fat stock classes has demonstrated their high ability to pick out prize animals from market lots and to feed and finish them to perfection.

The champion steer among the Shorthorns was from Purdue University, and the University of Nebraska won a prize on a yearling steer. Ohio State University took a large number of prizes on its swine, including the grand championship in several classes. Numerous awards were also made to the Iowa College on its pigs, and to the University of Wisconsin on its sheep and on finished carcasses, in addition to those in the college and station specials.

The showing made by the colleges in the open classes was very gratifying in view of the limited means of these institutions for acquiring and breeding live stock. Their success has again given rise to complaint against allowing them to participate, on the ground that they are backed by public funds. It hardly seems probable that such a protest voices the feeling of any considerable number of exhibitors, or that it can represent the more liberal and broad-minded element among them. It is understood to carry no antagonism toward the colleges, but to be one of principle against the competition of private exhibitors with public institutions. As such, however, the objection does not seem to be well taken or to represent the highest interests of the live-stock industry. As one of the leading agricultural papers has remarked, the object of the exposition, conducted at such great expense, is to educate by the exhibition of the highest class of animals, and rises far above the mere division of prize money among individual exhibitors.

As a matter of fact, the grand champions for the past four years have been purchased in the open market at market prices, or at auction, and any advantage which the colleges and stations may have had has been in the line of ability rather than of funds. In feeding and fitting these animals no secret practices have been followed. The conditions are a matter of careful record and the results are therefore a contribution to the practice of feeding. The protest is a compliment to the institutions, for it is an acknowledgment of their abilities and their facilities for teaching animal husbandry. "If the college men can beat the practical breeders in breeding, selecting, and feeding animals, it is a fine thing for the public to know." They have so long been held in disregard, and so recently in connection with this International Exposition, that if they are now showing unmistakably that they are

coming into their own, the fact should call for congratulation rather than discrimination.

The increasing prominence of the agricultural colleges and experiment stations in connection with this show is one of the striking illustrations of the change in attitude toward these institutions. Their success in open competition with the world's masters has had great influence in popularizing agricultural education. Everywhere the college and station men were greeted and referred to with respect. Farmers in the audience were pointing them out to one another, and in the judging ring they were much in evidence. These things have demonstrated the practical character of the colleges and the high degree of confidence now reposed in their specialists.

Of the list of judges at the show, nine were men connected with the agricultural colleges and experiment stations, and they judged in nearly one hundred and fifty classes of horses, cattle, sheep, and swine, being in many classes the only judges. Their work was repeatedly commended for the soundness of judgment displayed, and the reasons for their decisions were uniformly intelligible and freely given. As formerly, Prof. C. F. Curtiss, who is one of the directors of the exposition, was an active member of the executive committee and one of the conspicuous figures of the exposition.

This is indeed a great change. It is worth a great deal to have attained, and those who have brought it about have reason to be proud and deserve much credit. As measured by other attempts to popularize this form of education, the effort must commend itself as entirely legitimate.

For a long time the agricultural college instructors, following the course of other educational institutions, sat in their class rooms waiting for students and teaching the few who chose to come. Later they went after the farmer, met him on his own ground by any means they could devise, and by sheer force of argument demonstrated their practical nature and usefulness to him, and gradually changed their title from one of derision to respect and confidence. The man who scoffs at the college and station expert now is likely to be pitied in return; and in bringing about this change of feeling, especially as related to the important branch of animal husbandry, the International Live Stock Exposition has been an important factor.

CONVENTION OF ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, 1905.

H. W. Lawson,
Office of Experiment Stations.

The twenty-second annual convention of the Association of Official Agricultural Chemists was held at the George Washington University, Washington, D. C., November 16–18, 1905, C. L. Penny, of Delaware, presiding. The attendance was unusually large, as was also the number of papers and reports presented.

In his opening address, President Penny stated that while in the main the association's work had shown gratifying improvement in the uniformity of analytical results for phosphoric acid and potash, the results with nitrogen were less satisfactory. Much of the variation with the Kjeldahl method was believed to be due to the manner of digestion, which subject was discussed in some detail. The speaker urged that the technological questions of analysis should not be left as finished work. He emphasized the importance of permanent reference samples, and suggested as one of the most urgent questions for consideration the correct valuation of basic slag. The institution by the association of vegetation tests for studying the availability of plant food was characterized as an important forward step.

During the course of the meetings, Honorable James Wilson, Secretary of Agriculture, and Prof. William M. Hays, Assistant Secretary of Agriculture, made brief addresses expressing interest in the work of the association, and commenting especially upon the progress made in the suppression of food adulteration.

A resolution offered by R. J. Davidson, that at future meetings all reports and papers be presented by title or abstract, precipitated considerable discussion, which brought out the feeling that some regulations concerning the presentation of reports and papers and the participation in discussions were desired. The matter was referred to the executive committee.

The following officers were elected for the coming year: *President*, C. G. Hopkins, Urbana, Ill.; *Vice-President*, J. P. Street, New Brunswick, N. J.; *Secretary*, H. W. Wiley, Washington, D. C.; *Additional members of executive committee*, H. Snyder, St. Anthony Park, Minn.;

and M. B. Hardin, Clemson College, S. C. The referees and associate referees will be announced later.

Some of the more important features of the convention are summarized below.

SUGAR.

The referee, L. S. Munson, reported that the work done during the year was largely a continuation of the lines of investigation reported upon at the last meeting. The results, as a whole, were considered extremely gratifying, especially as regards methods for the determination of various reducing sugars in mixtures of dextrose and levulose in the presence of sucrose, methods for molasses analysis, and the unification of methods for reducing sugars.

The referee recommended that the work on sugars be continued until uniform methods are obtained for the various reducing sugars, and that copper-sugar factors be determined for the various concentrations of the different reducing sugars and for various mixtures and proportions of sucrose and reducing sugars, which was approved. He also recommended that the methods selected by the International Committee for Unifying Methods of Sugar Analysis be made official; that the method for the determination of copper in the cuprous oxid precipitate requiring reduction in hydrogen, and also the electrolytic methods C and D, on page 38 of Bureau of Chemistry Bulletin 46, be dropped as official methods; and that Low's thiosulphate method, as given in the report of the referee, be substituted for the volumetric permanganate method of the association. Action on these recommendations was deferred for one year.

The report on special analytical methods, by C. A. Browne, jr., associate referee, embraced a study of a method for the analysis of simple mixtures of reducing sugars, further trials of a method for the determination of dextrose, levulose, and sucrose in mixtures, and a study of the influence of temperature upon the polarization of raw cane sugars. The recommendations that the work upon the separation of sugars be submitted to collaborative tests, and that the work upon the identification and determination of the various organic solids-not-sugar, upon which some progress was made during the year, be continued, were approved by the association.

The associate referee on molasses methods, H. E. Sawyer, presented a verbal report giving some general results obtained with his method of examining dark molasses, in which the normal weight is made up to 500 cc. Recommendations regarding changes in the official methods were deferred until the next meeting. The recommendations that a further study be made of the choice of a constant or variable factor for employment in the Clerget equation and that a table of logarithmic factors be prepared for use with the new modification of the Soxhlet

solution in computing the percentage of reducing sugars were approved by the association.

P. H. Walker read a paper entitled A Uniform Method for the Determination of Reducing Sugars, in which a modified method for the determination of both dextrose and invert sugar was described. This was designed to avoid confusion in work on reducing sugars arising from using Allihn's tables for dextrose and Meissl's tables for invert sugar.

TANNIN.

The report of the referee, H. C. Reed, contained the results of extended collaborative investigations, and was presented only in abstract. The following subjects were recommended for collaborative research during the coming year: (1) Soluble solids filtration, (2) analysis of liquors and the effect of the acidity of the liquors upon the analysis, (3) estimation of acid in tan liquors, (4) the influence of acidity and alkalinity upon the chroming of hide powders and upon the subsequent analysis, (5) extraction, (6) the Parker-Payne method of tannin analysis, and (7) estimation of nitrogen in leather and tan liquors. Methods adopted provisionally included the chroming of hide powder by the addition of the entire amount of chrome alum at one time, limiting the moisture content of wet chromed hide powder used for analysis between 70 and 75 per cent, the analysis of liquors as detailed in the report of the referee, and use of the form of apparatus known as the combined evaporator and drier. Action was deferred until the next meeting upon a method for tannin analysis which was proposed for an official method.

A paper on the Extraction of Tanning Material for Analysis was presented by F. P. Veitch.

A communication was received from a committee representing the American Leather Chemists' Association in which it was suggested in substance that the two associations appoint the same referees, or that the Association of Official Agricultural Chemists abandon work on tannin. The communication was referred to the referee for report at the next meeting.

INSECTICIDES, FUNGICIDES, AND DISINFECTANTS.

The report on this subject was submitted by the referee, B. H. Smith. The work followed suggestions of the previous referee, and included comparative analyses by several chemists of samples of Paris green, London purple, tobacco extract, soda lye, sulphur dip, formaldehyde, chlorid of lime, and a phenolic disinfectant. An examination of 28 samples of commercial formaldehyde from various sources showed an average strength of approximately 37 per cent of formaldehyde. The

two modifications of the Avery-Beans method of determining total arsenic in Paris green, recommended for adoption last year, were made official, as was also the thiosulphate method of determining copper.

In a supplementary paper the referee reported the results of some investigations showing the rapidity with which bleaching powder loses chlorin upon standing, largely due to the chemical changes taking place within the product itself.

The results of a study of the lime-sulphur-salt-soda wash, carried out along the same lines as recent investigations on the lime-sulphur-salt wash (E. S. R., 17, p. 55), were presented in a paper by J. K. Haywood. The two washes were found to decompose in the same manner, except that the rate of decomposition of the lime-sulphur-salt-soda wash was much slower. By substituting soda for lime, the author has prepared, in laboratory experiments, an insecticide which does not require boiling in its preparation and which corresponds, so far as chemical changes are concerned, to the lime-sulphur wash and which he recommends for practical trial. The proposed formula is as follows: Water 20 gal., powdered sulphur 7¾ lbs., and caustic soda (98 per cent) 4 lbs. The salt was not found to enter into the changes taking place in this material.

FOODS AND FEEDING STUFFS.

Neither the referee, J. O. La Bach, nor the associate referee, J. K. Haywood, presented reports upon this subject.

C. A. Browne, jr., recommended that a committee be appointed by the association for the purpose of establishing standards for the composition of various unmixed feeds, such as wheat bran, rice bran, cotton-seed meal, etc. By vote of the association this matter was referred to the committee on food standards. Doctor Browne also recommended that the method adopted by the Fifth International Congress of Applied Chemistry for the analysis of molasses feeds be adopted by the association as an official method. Action on this recommendation was deferred until next year.

FOOD ADULTERATION.

Brief remarks were made by the referee, W. D. Bigelow, on the work as a whole. Reports of 12 associate referees which were presented are noted below. No reports were offered on the subjects of wine, beer, vinegar, baking powder and baking chemicals, infants' and invalids' foods, vegetables, condiments other than spices, and cocoa and cocoa products, for which the association has associate referees. The appointment of an additional associate referee on the determination of water was authorized.

During a recess of the convention an informal meeting of food chemists was held at which A. McGill demonstrated certain simple tests

for the detection of food adulterations, and McGill, W. D. Bigelow, L. M. Tolman, R. E. Doolittle and others discussed with decided want of agreement the advisability of placing such tests in the hands of dealers and others not trained in chemistry.

Colors.—W. D. Bigelow stated that the associate referee on colors, W. G. Berry, had completed an exhaustive compilation of literature on the subject of coloring matter, which is now being printed.

Saccharine products.—The report on saccharine products, by J. Hortvet, presented the results of comparative analyses of maple sugar and sirup by a number of analysts. The methods employed were published in Circular 23 of the Bureau of Chemistry and were adopted as provisional.

C. H. Jones called attention to the work which has been carried on at the Vermont Station, stating that a satisfactory method for the detection of cane sugar in maple products had been devised. (See E. S. R., 17, p. 219.)

Fruit products.—In the report of E. M. Bailey it was stated that the work of the associate referee on fruit products had been confined to an effort to devise a practical method for the determination of water in dried fruits. Comparative results in drying prunes, peaches, apricots, and apples with and without sand were reported. Drying with sand gave slightly higher and presumably more accurate results. Drying for 30 hours at 100° C. and cooling in a desiccator for at least one hour before weighing was recommended.

The determination of moisture was further discussed by William Frear, who called attention to Benedict's method of drying at normal temperatures, and by H. W. Wiley, who spoke of the method recently described by L. Maquenne (see p. 437) and of drying in a partial vacuum as carried out in the Bureau of Chemistry. The referee on food adulteration was requested to assign the methods of determining moisture mentioned for testing during the coming year.

Distilled liquors.—The report on this subject, presented by C. A. Crampton, dealt mainly with the determination of fusel oil. The method of A. Trillat and that of Riche and Bardy for the detection of methyl alcohol in distilled liquors, and the method of Leach and Lythgoe for the estimation of ethyl and methyl alcohol in mixtures, were recommended for adoption as provisional methods, which was done. A method of determining aldehydes was offered as a substitute for the one given on page 97 of Bulletin 65 of the Bureau of Chemistry, and methods of determining ethereal salts and furfurol were offered as substitutes for those given on page 98 of the same bulletin. These methods were adopted as provisional, as was also Allen and Marquard's method for fusel oil.

H. E. Sawyer described some methods employed by him in examining distilled liquors, and stated that aniline dyestuffs were coming into

use in coloring liquors. H. W. Wiley spoke on the color and adulteration of whisky in the United States and abroad. A paper on artificial coloring matter in whisky, by P. H. Walker and J. H. Schreiber, gave the results of tests of a number of methods employed in the examination of a large number of samples of whisky for artificial coloring matter.

Vinegar.—No report was presented on this subject. The detection of malic acid, however, was discussed by L. M. Tolman and L. L. Van Slyke, and upon motion of the former it was agreed to eliminate from the printed method the statement that the presence of malic acid distinguishes cider vinegar and also the tests with silver nitrate and barium chlorid.

In a paper on the determination of solids in cider and vinegar, by J. A. La Clerc and L. M. Tolman, it was stated as quite possible to obtain a correct estimation of solids in cider and vinegar by exposing them in a flat-bottomed evaporating dish in a live steam bath for two hours. Another paper by the same authors showed that cider prepared by pressing pomace which had been allowed to lie in large heaps for ten days or more varied considerably in composition from that prepared from pressing the juice from freshly ground apples. It was considered that the addition of second-pressing to first-pressing cider can be readily detected by the presence of considerable quantities of pentosans and galactans in the second-pressing cider.

Flavoring extracts.—E. Chase reported that no satisfactory work had been done upon flavoring extracts during the year. An outline for future work along this line was presented and approved. Leach's test for coumarin, the colorimetric ferrous-sulphate method for determining vanillin, Winton's modification of the Hess and Prescott method for the determination of vanillin, coumarin, and acetamid, and Leach and Lythgoe's refractometric method for the detection of methyl alcohol were adopted as provisional methods.

Spices.—A. L. Winton reported that the work during the year had been confined to the analysis of prepared mustard, with the view of developing suitable analytical methods and gaining an idea of the range in composition of commercial products. A compilation of methods of analysis for prepared mustard was presented and numerous analyses were reported. The methods were adopted as provisional.

Meat and fish.—In the report on meat and fish, by M. E. Jaffa, determinations of some nitrogenous constituents in raw meat were reported.

Fats and oils.—L. M. Tolman reported that cooperative work on the titer test during the year had brought this subject to such a stage that a method including the use of a standard thermometer, which was described, was recommended for adoption as provisional, which was done. A further study, however, of the method of drying fatty acids

was recommended. The methods classified under the name of the cold test were collected and studied. This test was defined as the congealing or solidifying point of an oil. The associate referee was inclined to believe that the test used by Armour & Co. was the best of the methods given and, if improved by the addition of time element, would prove satisfactory. Unknown mixtures of lard and beef tallow were sent out for cooperative work on the Belfield test, and the reports of nine chemists were considered as indicating that where a satisfactory method was used, there was no difficulty in detecting additions of beef tallow to lard. Further work was considered necessary before a satisfactory method could be devised. The correction for temperature with the refractometer, recommended in 1903 (Bureau of Chemistry Bul. 81, p. 64), was adopted as official, as was also the Hanus method.

Dairy products. —This report, by A. E. Leach, dealt with the examination of milk by means of the Zeiss immersion refractometer. A minimum standard of 39° was adopted, below which it was considered safe to allege that the sample was fraudulently watered, especially if in addition to this the solids-not-fat were below 7.3 per cent. Analytical data, obtained by the associate referee, by R. B. Fitz Randolph of New Jersey, and by J. Hanley of Liverpool, England, were included in the report. The refractometric method of Leach and Lythgoe for the detection of water in milk was adopted as a provisional method.

Cereal products.—No formal report was presented on the subject of cereal products, but the associate referee, A. McGill, called attention to certain physical tests used in the examination of flour, and recommended further work.

Cocoa and cocoa products.—A paper on cacao starch was read by B. J. Howard. The author's studies were occasioned by statements that it was possible to change cacao starch by heating in the process of roasting into aggregates resembling other starches. He failed to produce starchy masses resembling wheat and potato starch, and believed that with the microscope, and more especially with the micropolariscope, the question of foreign starches in cacao products can be established, care being exercised to make sufficient micro-chemical tests to establish beyond a doubt that the masses under consideration are starch and not fat globules.

Tea and coffee.—No cooperative work had been done during the year, but H. C. Lythgoe reported that the methods submitted at the last convention had been used with marked success in the laboratory of food and drug inspection of the Massachusetts State Board of Health for the approximate quantitative determination of the ingredients of samples of adulterated coffee.

Preservatives.—W. D. Bigelow stated that analyses were made of a number of products which had been canned with and without the addition of preservatives, the results of which showed that in no case where

preservatives had not been used was any reaction obtained that could be interpreted as indicating the presence of chemical preservatives. Methods for the detection of formaldehyde, benzoic acid, salicylic acid, saccharin, boric acid and borates, fluorids, and in some instances methods of quantitative determination, were presented in the report and adopted provisionally by the association.

DAIRY PRODUCTS.

A report on this subject by the referee, G. E. Patrick, gave the results of studies on the effects of preservatives on the determination of albumin and casein in milk and of tests for renovated butter.

The referee for next year was instructed to continue the study of the effect of preservatives on the determination of the proteids of milk, and to study methods for determining sugars in condensed milks and dried milks or milk powders, and also methods of detecting adulteration of butter with small quantities of foreign fats.

A paper on milk analyses by calculation, by G. A. Olson, was also presented. The author uses the following formula: $P = .368T + .33A - .383F$, in which P = proteids, T = total solids, A = ash, and F = fat. By using Richmond's or Babcock's formula for total solids and assuming that all milk contains a definite amount of ash, namely 0.75 per cent, a complete analysis can, therefore, be computed from determinations of specific gravity and fat content, sugar being obtained by difference. Comparative data obtained by gravimetric analysis and by calculation were reported.

SOILS.

The referee, C. G. Hopkins, explained why the work recommended last year had not been carried out. He presented the results of a pot culture experiment on the comparative value of steamed bone meal and finely ground raw rock phosphate. As a general average, wheat made slightly better gains with the rock phosphate than with the steamed bone meal.

A modified method for the determination of total phosphorus in soils was presented in a paper by J. H. Pettit and A. Ystgard, and comparative determinations by the method described and the alkali carbonate method were reported.

In a paper on the proper strength of acid to be used for determining available plant food in soils, by A. M. Peter and S. D. Averitt, were presented the results of determinations with $\frac{1}{10}$, $\frac{1}{20}$, and $\frac{1}{40}$ normal nitric acid, along with those obtained by the authors with $\frac{1}{5}$ nitric acid and $\frac{1}{200}$ hydrochloric acid the previous year. Preference was expressed for the $\frac{1}{5}$ normal nitric acid.

B. L. Hartwell and J. W. Kellogg reported determinations of the phosphoric acid removed by crops, by dilute nitric acid, and by

ammonium hydroxid from a limed and unlimed soil receiving various phosphates. The results with flat turnips indicated that this crop may serve a useful purpose in testing the relative assimilability of different phosphates. Ammonium hydroxid of $\frac{1}{5}$, $\frac{1}{25}$, and $\frac{1}{100}$ normal strength and nitric acid of $\frac{1}{100}$ and $\frac{1}{25}$ normal strength failed to extract from the soil amounts of phosphorus corresponding to crop results. It was considered doubtful if any solvent will extract from all soils amounts of phosphorus bearing relations to those removed by a given crop.

F. P. Veitch presented in abstract a paper on The Effect of Fertilizers on the Reaction of Soils. The reaction and acidity of some of the limed and unlimed plats, which had received different fertilizer treatment in the rotation experiments of the Ohio Experiment Station, were determined by the lime-water method and by the sodium-chlorid method and it was found that those unlimed plats which had received large applications of sodium nitrate, either alone or in conjunction with phosphates and potash salts, were less acid than those plats receiving no nitrate. Acid phosphate alone slightly reduced acidity, but with other materials produced no change. Potassium chlorid did not change the acidity of the soil. The results obtained on this soil are not considered to be of general application to soils of different constitution.

The same author also presented a paper on Plant Growth as Influenced by Soil Acidity. The results of experiments with red clover, cowpeas, alfalfa, tomato, lettuce, wild marsh grasses, corn, and timothy were considered as indicating the desirability of rendering the soil faintly alkaline with calcium carbonate rather than stopping with smaller applications, and it was suggested that possibly with very sensitive plants, such as alfalfa, it may be necessary to incorporate the lime to a greater depth than can be done by the ordinary harrow or cultivator.

INORGANIC PLANT CONSTITUENTS.

Samples of corn meal, ground oats, cotton-seed meal, and white mustard were sent out by the referee, R. W. Thatcher, for collaborative work on the determination of sulphur by the nitric-acid, sodium-peroxid, Barlow-Tollens, and chromyl-chlorid methods. The results were considered as proving conclusively that the nitric-acid method does not yield all the sulphur present in plant tissues. The peroxid method was considered the most accurate and feasible method. The combustion method of Barlow-Tollens proved satisfactory to the two chemists who used it. The chromyl-chlorid method gave unsatisfactory results. It was recommended that the provisional nitric-acid method be dropped and the peroxid method be adopted provisionally, which was done. The referee for next year was requested to investigate the Barlow-Tollens method as a means of distinguishing between organic sulphur and sulphur of the ash.

POTASH.

The report of the referee, G. S. Fraps, dealt with the determination of water in kainit and mixed fertilizers and the volumetric method for potash. In the determination of potash the modified method which provides for the use of an acid solvent was found to be more satisfactory than the official method. Experiments were made to ascertain how much potash would be removed from insoluble silicates by the modified method, from which the conclusion was drawn that this method does not open the way for the potash-bearing silicates for fillers, as the amount of potash that could be so added is insignificant. While believing that the modified method is accurate, the referee hesitated to give it his unqualified indorsement, inasmuch as the laws of 27 States require potash to be soluble in water. The referee recommended that the volumetric method be further studied with particular reference to its use in soil analysis, which was approved by the association. The referee for next year was also instructed to study, in the determination of potash in mixed fertilizers, incineration at low temperature and solution in dilute acid.

The discussion showed a considerable difference of opinion as to the availability of organic potash and the advisability of using an acid solvent in determining potash in mixed fertilizers. It was suggested that the different forms of potash be determined and stated.

A paper on the use of acetic and oxalic acids for extracting the charred material in preparing ash, by B. L. Hartwell and J. W. Kellogg, was read by title. The amount of crude ash was generally greater when oxalic acid was used.

DETERMINATION OF NITROGEN.

A letter from the referee, F. W. Robinson, stated that there were no results ready to report on this subject.

By vote of the association the referee for next year was instructed to study the addition of ½ to ¾ gm. of copper sulphate after digestion with sulphuric acid and potassium sulphate in the determination of nitrogen by the official Gunning method.

R. J. Davidson proposed a change in the method of standardizing the hydrochloric acid used in the determination of total nitrogen.

SEPARATION OF NITROGENOUS BODIES.

The report on milk and cheese proteids was submitted by the referee, R. Harcourt. The method elaborated by Van Slyke and Hart for the separation of nitrogenous bodies in cheese was subjected to collaborative tests. Eight chemists reported results which formed the main part of the report. The referee recommended that the work be continued, special attention being given to the problem of making a com-

plete extraction of water-soluble nitrogenous bodies and to their complete separation in filtering; that in making the extract the amount of water be increased from 500 to 1,000 cc.; and that after the fat and insoluble nitrogenous bodies have been removed by absorbent cotton the filtrate be passed through asbestos. The recommendations were approved.

J. S. Chamberlain, associate referee on vegetable proteids, reported that no cooperative work had been planned and carried out. The method of H. T. Brown for the separation of the nitrogenous bodies in barley and malt was recommended, and was adopted as provisional by the association.

A paper entitled Notes on the Determination of Albuminoid Nitrogen in Cereals, by J. A. La Clerc and W. C. Lounsbury, was read by title.

W. D. Bigelow, associate referee on meat proteids, presented a verbal report on work done by him and F. C. Cook on the separation of albumoses and peptones from the lower amido bodies by the use of the tannin and salt reagents.

PHOSPHORIC ACID.

The referee, E. W. Magruder, made a verbal report on this subject, speaking of the determination of the neutrality of the citrate solution and suggesting that the determination of iron and alumina in phosphates be further studied.

By vote of the association the referee for the coming year was instructed to study and make a report at the next meeting on the official examination of basic slag phosphates, on the determination of iron oxid and alumina in rock phosphates, and on the neutrality of the ammonium citrate solution as actually used by analysts.

A modified method of determining phosphoric acid was submitted by A. B. Foster, and some results obtained were reported.

MEDICINAL PLANTS AND DRUGS.

The referee, L. F. Kebler, recommended that the association adopt the method prescribed by the eighth revision of the United States Pharmacopœia for the assay of opium as a provisional method that the work on the analysis of opium be continued and extended to ipecac and golden seal; and that associate referees be appointed to take up different features of the work.

SPECIAL COMMITTEES.

Food standards.—A report of progress was submitted by the chairman of the committee, W. Frear. It was stated that standards for a number of products were decided upon during the year and that tentative standards were also drawn up and distributed to those interested.

Fertilizer legislation.—The chairman of the committee, H. W. Wiley, reported that considerable progress was made during the year in the duties assigned to the committee, and that the committee had agreed upon the principles which it was believed should underlie interstate traffic, but was not ready to recommend legislation. The committee was continued with instructions to consult various organizations interested in the matter and to report at the next meeting.

In this connection a paper, by R. E. Rose, was submitted in which the following question was discussed: What Variations from Maximum Guaranteed Analysis and Fertilizers shall be Considered Adulterations or Deficiencies?

Testing chemical reagents.—The committee on testing chemical reagents, L. F. Kebler, chairman, considered that the amount of information at present available to the committee was insufficient to recommend any action relative to the adoption of standards for the chemicals so far investigated. Upon the recommendation of the committee the work was ordered to be continued and extended to include 10 additional chemicals which in the opinion of the committee may be considered most important. The chairman exhibited a number of samples of impure chemicals.

Unification of terms for reporting analytical results.—R. J. Davidson, chairman of the committee, reported that a statement had been prepared on this subject by the committee and published and distributed in pamphlet form by the Bureau of Chemistry, but that the committee was not yet ready to make a final report. The committee was continued.

Unification of soil methods.—L. L. Van Slyke, chairman of the committee, reported that the only feasible plan for accomplishing the desired results, in the opinion of the committee, was in the line of the traditions established by the association, namely, studying all proposed methods by referees supplemented by individual work in laboratories, the methods examined to stand or fall by the results reached. The committee requested that it be discharged from further action, which was done.

Definition of "plant food."—H. W. Wiley, chairman of the committee, reported that during the year extensive correspondence had been carried on with a similar committee representing the botanists of the United States. No agreement was obtained between the two committees. The committee of the association was of the opinion that "plant food is a term which should be applied to bodies entering the organism of the plant from without and taking part in its metabolic activity, whether these bodies be organic or inorganic in character." The committee recommended that further conference be had with the botanists, and if no common ground for a definition be found that the committee prepare a definition of plant food to be reported at the next meeting.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The practice of agricultural chemists, M. Passon (*Die Praxis des Agrikultur chemikers. Stuttgart: Ferdinand Enke, 1905, pp. VIII + 295, pls. 5*).—This book describes the various materials which the agricultural chemist is likely to be called upon to examine, and gives in some detail the analytical methods suited to such examination.

The subjects treated are fertilizers, including various forms of nitrogenous, phosphatic, and potash fertilizers, mixed fertilizers, calcareous manures, fraudulent fertilizers, barnyard manure, composts, and night soil; the soil, including investigation of various soil types, the valuation of soils on the basis of chemical analysis, soil tests with fertilizers, and the examination of the products obtained in such tests; feeding stuffs, including various by-products of oil making, milling, and other industries; and briefer sections relating to milk, butter, margarin, water, and seed.

On the determination of magnesium and phosphoric acid as magnesium pyrophosphate, K. K. Järvinen (*Ztschr. Analyt. Chem., 44 (1905), No. 6–7, pp. 333–342; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 514, II, p. 555*).—In the method proposed the solution, which should not contain a great excess of ammonium salts, is exactly neutralized, using lacmoid as indicator. A slightly ammoniacal solution of diammonium phosphate is then added drop by drop.

When time has been given for the greater part of the precipitate to separate 1 per cent ammonia is added and then 10 per cent ammonia in quantity equal to one-third of the volume of the whole. After standing 2 hours the precipitate is collected on a filter, dried, ignited over a Bunsen flame, and weighed. Ammonium oxalate in moderate quantity has no effect on the precipitation.

An alkalimetric method of determining phosphoric acid in the presence of other acids and its application in the examination of phosphatic materials, V. Boulez (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 746, 747*).—The method is based upon the difference in behavior of phosphoric acid and other acids toward methyl orange and phenolphthalein as indicators.

Further notes on simple methods of determining potash, F. Klinkerfues (*Chem. Ztg., 29 (1905), No. 81, pp. 1085, 1086*).—Referring to his previous note on this subject (E. S. R., 16, p. 843), the author calls attention to the fact that it is not necessary to evaporate to complete dryness after the addition of formic acid, and that by taking advantage of this fact the operation is greatly shortened. He also describes an adaptation of his method for potash to the determination of nitrogen in potash-free ammonium salts.

The new Paul Wolff apparatus for the determination of lime in high percentage marls, P. Sommer (*Deut. Landw. Presse, 32 (1905), No. 82, p. 692, fig. 1*).—The apparatus described is adapted to marls containing over 50 per cent of calcium carbonate. Two gm. of the marl is decomposed by boiling with 50 cc. of normal hydrochloric acid, for which a special pipette is provided. The excess of acid is titrated (using phenolphthalein as indicator) with ½ normal sodium hydroxid

solution, which is run into the flask from a burette so graduated that its readings indicate directly the percentage of calcium carbonate.

On the question of the separation of iron and aluminum from manganese, calcium, and magnesium in the analysis of plant ashes, P. KASCHINSKY (*Jour. Landw., 53 (1905), pp. 179–185*).—A series of comparative tests of König's method (precipitation of iron phosphate in presence of ammonium acetate) and Tollens's method (precipitation in presence of acetic acid) is reported. From the results the author concludes that neither of these methods gives accurate results, due to the fact that considerable amounts of calcium phosphate are precipitated with the iron phosphate.

Determination of the loss on ignition in soil analysis, H. MEHRING (*Jour. Landw., 53 (1905), No. 3, pp. 229–237*).—It is claimed that incineration with ammonium carbonate gives a greater weight than that which can be ascribed to the restoration of carbon dioxid which would be lost by ignition without the use of carbonate.

The loss on ignition is a very indefinite factor, and is made up of three main elements, carbon dioxid driven off, chemically combined water eliminated, and organic matter destroyed. The use of ammonium carbonate in ignition increases rather than decreases the error of the determination. It is claimed that the determination of humus by combustion with copper oxid or chromic acid is more reliable and useful than incineration.

On the difficulty of detecting small variations in the nitrogen content of soils by means of the Kjeldahl method, R. THIELE (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 2, pp. 157–178, figs. 4*).—This article reviews very thoroughly the literature relating to the sampling of soils and discusses the difficulty of securing representative samples showing with accuracy the small differences occurring in the plant-food constituents, particularly nitrogen, in soils.

A series of determinations of nitrogen (5 for each sample) by the Gunning-Atterberg method in 24 samples of soil, composites of samples from 10 different places at regular intervals on 200 square meter plats, are reported, and the results are platted in comparison with the curve for rainfall for the period during which samples were taken. Examinations were also made of 10 samples of soil made up from portions of 10 spadefuls of soil taken around the 10 selected points.

The results indicate that it is not possible to get a strictly representative sample of a large area by present methods of sampling, but that it is possible to detect by chemical analysis much smaller variations in nitrogen content than are likely to be of significance in experimental work.

Determination of nitric acid in the presence of organic substances, B. PFYL (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1–2, pp. 101–104, fig. 1; abs. in Analyst, 30 (1905), No. 355, pp. 345, 346, fig. 1*).—The method described is based upon the reduction of the nitric acid to nitric oxid by means of ferrous chlorid and hydrochloric acid, the nitric oxid being washed by passing it through sodium hydroxid solution and absorbed by one-tenth normal potassium permanganate solution. The excess permanganate solution used is titrated with tenth normal ferrous chlorid solution. A special form of apparatus for use in the reduction is described.

Methods of examination of potable waters and the interpretation of the results, F. DIENERT (*Ann. Inst. Pasteur, 19 (1905), No. 9, pp. 541–563, figs. 4*).—Various methods of examining potable waters are discussed in this article, especial attention being given to a method based on electric conductivity, which is described in detail, and which it is claimed is well adapted to a study of variations in underground waters. This method with quantitative determinations of *Bacillus coli communis* is believed to furnish an adequate basis for judging of the sanitary quality of waters.

The estimation of cellulose and lignin in feeding stuffs and foods, J. KÖNIG (*5. Internat. Kong. Angew. Chem., 5 (1903), Ber. 3, pp. 1052–1060*).—The author

describes his method of determining crude fiber in food or feeding stuffs by means of a mixture of glycerin and sulphuric acid (E. S. R., 9, p. 1021). The amount of lignin in the crude fiber can be determined by treatment with hydrogen peroxid to which ammonia has been added. This reagent dissolves the lignin, leaving the pure cellulose behind.

The cleavage products of starch, A. Rössing (*Chem. Ztg., 29 (1905), No. 66, pp. 867–873*).—This article has to do with the cleavage products obtained by hydrolysis of starch with hydrochloric acid, their estimation in starch sugars and sirups, and their effect upon the use of the latter in the confectionery industry.

According to the author, the hydrolysis of starch with hydrochloric acid under suitable conditions gave a modification of the ordinary glucose, which may be detected by its lower reducing power under the influence of barium hydroxid. The lower reducing power is due largely to the formation of lactic and other organic acids and serves for the determination of normal glucose and dextrin.

In addition to abnormal glucose, unfermentable bodies, dextrin, and reversion products were also obtained which have a strong reducing power and are hygroscopic. The author believes that the use of starch sirup obtained in this way in confectionery should not be permitted.

The analysis of wheat flour for commercial purposes, H. Snyder (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 702–710, pls. 2*).—Different factors which should be studied in the commercial analysis of flour are recorded and analytical methods described. The author believes that it is possible to judge of the quality of flour and that satisfactory and definite standards can be formulated.

The estimation of moisture in bread, A. Pagniello (*Bol. Chim. Farm., 43 (1904), pp. 309–313; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 11, p. 693*).—The amount of water in crust and crumb of bread was determined by heating samples weighing 50 to 100 gm. for 7 hours in a drying oven at 105 to 110° C. and calculating the amount of water in the original loaf.

On the absolute desiccation of vegetable materials, L. Maquenne (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 16, pp. 609–612*).—Starches and flours placed in tubes through which a current of dry air was forced to pass at the rate of about 1 liter per hour, and dried in a thermostat at 120° C. for 1 hour or 100° for 2 hours, showed about 1 per cent more moisture than samples dried in the ordinary way.

The harmfulness of artificial colors in foods, G. Schacherl (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 1041–1048*).—A summary and discussion of data regarding artificial coloring matters and their use in food products.

A simple method for determining boric acid quantitatively, O. von Spindler (*Chem. Ztg., 29 (1905), No. 43, pp. 582–584*).—The author describes a modification of the method of estimating boric acid which depends on the fact that it is volatilized with methyl alcohol and may be distilled with this reagent.

On fat determination in milk, T. S. Thomsen (*Mælkeritid., 18 (1905), No. 18, pp. 359–365*).—The author explains the lower results obtained by the extraction method of milk analysis as compared with the Gottlieb method (in the author's analyses, amounting to 0.38 to 0.06 per cent for buttermilk, and 0.26 to 0.03 per cent for skim milk), by an incomplete extraction of the fat in the milk solids, because the casein protects some of the fat from the action of the ether. When the casein of the milk was peptonized previous to the drying of the milk, identical results were obtained by the two methods, both in the case of buttermilk, half-skimmed milk, and skim milk high or low in fat. The peptonization did not, on the other hand, affect the results obtained by the Gottlieb method.

The peptonization of the milk was conducted in the following manner: To 3 drops of strong hydrochloric acid placed in the dish to be used for the determination of the solids in the milk were added 10 cc. of milk, and finally about 0.1 gm. of strong

pepsin dissolved in about 1 cc. of water. The whole was then stirred with a platinum wire and left for about 2 hours at 40° C., and then at room temperature until the following day, when as much of a mixture of 9 volumes of granular kaolin and 1 volume barium carbonate was added as was necessary to absorb completely the contents of the dish. The material was then placed in a drying oven for 4 to 5 hours at about 98° C., and the desiccated mass finally extracted with anhydrous ether. The pepsin used was found free from ether-soluble substances.

The author concludes that the Gottlieb method gives correct results, and should be used to the exclusion of the extraction methods in the analysis of milk low in fat.—F. W. WOLL.

Contribution to the detection of watered milk, O. BIALON (*Milchw. Zentbl., 1 (1905), No. 8, pp. 363-366*).—The specific gravity of milk serum is shown to vary irregularly with the method of coagulation employed.

In one instance the specific gravity of the serum obtained by spontaneous coagulation was 1.0284, by acetic acid 1.0266, and by rennet 1.0291. The variations are explained as due to the different amounts of phosphates, lime, and proteids left in solution. Complete analyses showed furthermore that the properties of the serum obtained by the same method are not constant. Instead of using determinations of total solids and specific gravity of the serum, the author would make use of the specific gravity of the fat-free milk determined by the formula:

$$\sigma = \frac{100s - f}{100 - \frac{f}{0.933}}$$

in which s represents the specific gravity of the milk, f the percentage of fat, and 0.933 the average specific gravity of milk fat. For pure milk σ or the specific gravity of the fat-free milk was found to be about 1.0323.

On the basis of a large number of determinations, the author concludes that a specific gravity of 1.0323 or above calculated by this formula shows that the milk is unadulterated, while a lower figure shows that water has been added. The method is, of course, not applicable to curdled milk.

Refractometric examination of milk, M. HENSEVAL and G. MULLIE (*Rev. Gén. Lait, 4 (1905), No. 23, pp. 529-538*).—Ripper's method of preparing the serum is preferred. This consists in adding 1 cc. of 20 per cent acetic acid to 50 cc. of milk, heating on a water bath to 65 to 70° C. for 5 minutes, cooling to 15° and filtering. The determination of the index of refraction may be made at room temperature and calculated to 15° by adding or subtracting 0.000117 for each degree that the room temperature is respectively above or below 15°.

The index of refraction of normal serum varies from 1.3429 to 1.3445. The principal refractive substances in the serum are lactose, salts, and albumin. The addition of 10 per cent of water to milk causes a decrease of about 0.00102 in the index of refraction. A lower index than 1.3425 may be accepted as an indication of watering. An abnormally high index would warrant a suspicion that soluble substances had been added.

The authors did not find that the index of refraction of the milk of diseased cows was always low, not even when a positive tuberculin reaction was obtained. Such, however, was often the case in mammary tuberculosis, but in those instances the milk could generally be recognized by its abnormal appearance. The milk of the healthy quarters showed a normal index. The lowering of the index was found due to a diminution of the lactose.

Cryoscopy of milk for detecting the addition of water, C. BARTHEL (*Rev. Gén. Lait, 4 (1905), No. 22, pp. 505-512*).—Numerous determinations are reported which go to show that the freezing point of milk is not appreciably affected by the individuality or breed of cows, the quarter of the udder from which the milk is obtained, the fat content of the milk, estrum, etc., but that it is very constant between

—0.55 and —0.57° C. The addition of water, however, makes a marked difference, and for the estimation of this cryoscopic examination is believed to be a valuable supplement to the usual determinations of specific gravity, fat content, and total solids.

Review of the literature of milk chemistry, R. W. RAUDNITZ (*Separate from Monatsschr. Kinderheilk., 3 (1905), No. 12; abs. in Milchw. Zentbl., 1 (1905), No. 8, p. 384*).

The commercial utilization of milk waste and more recent products of milk in dry form, J. A. JUST (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 870–891*).—The food value of milk, buttermilk, casein products, milk powders, and other commercial products is spoken of, as well as the use of milk by-products for feeding farm animals and for different commercial purposes, the article as a whole being a summary and discussion of the importance of milk by-products.

The quantitative analysis of lard, D. WESSON and N. J. LANE (*Jour. Soc. Chem. Indus., 24 (1905), No. 13, pp. 714–717*).—On the basis of experience different methods of determining the quality of commercial lard are discussed.

The authors conclude that "there is no method for the determination of tallow, its constants being very similar to lard, and it can only be detected qualitatively by the microscope. The phytosterol test is probably one of the best methods for detecting vegetable oil in lard, but is not mentioned in this paper, because it was not in use when the writers were doing the work described. . . . [The Wesson test for free fatty acids, the titer tests, the determination of the saponification value or the iodin value, the Hübl or Wijs method for liquid acids and their iodin value, and Wesson's cooling test] will give results which are within 2 to 3 per cent of the truth, and sufficiently close for commercial purposes. While the lard having the extraordinary iodin value of 115 on the liquid acids . . . may occasionally occur, it is too infrequent to be taken into consideration."

The chemical nature of the sugar product obtained by overheating, F. STOLLE (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 359–370*).—On the basis of investigations, the author concludes that in the manufacture of sugar the greater part of the colored matter which is commonly regarded as caramel is formed by the action of lime on nonsugar products, and that only a little caramel is formed. He considers caramel a true carbohydrate, and believes that it is formed from a sugar by the cleavage of two molecules of water at a temperature between 170 and 180°.

Experiments with caramel as a cleavage product of caramelan, F. STOLLE (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 370–377, fig. 1*).—The investigations summarized were undertaken with a view to studying the chemical composition of caramelan.

The quantity of sugar permissible in imported preserved pineapples, H. W. WILEY (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 105, 106*).—On the basis of data regarding sugar content of pineapples, the author recommends that pineapples imported into the United States contain not over 14 per cent sugar (estimated as reducing sugar), or more than an average of 13 per cent in a whole cargo. If more than this amount be present the goods should be regarded as pineapples to which sugar has been added and classified for duty accordingly.

The occurrence and estimation of organic acids of wines, A. PARTHEIL (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 1019–1022*).—According to the author's investigations, the usual method of estimating the total lactic acid in wine neglects the fact that lactic acid is volatile with water vapor. A method which he considers more satisfactory is proposed. This depends upon the fact that the barium salts of tartaric, citric, and succinic acids are difficultly soluble in 80 per cent alcohol and that in the filtrate from these salts the lactic and acetic acid can be distilled with water vapor and estimated without difficulty by means of the carbon-dioxid reaction.

Household chemistry, H. T. Vulté and G. A. Goodell (*Easton, Pa.: Chemical Publishing Co., 1904, pp. 88*).—In this volume, which is designed as a guide and introduction to the study of household science, some directions for laboratory manipulations are given, and air and water, fuel, food constituents, milk testing, antiseptics and preservatives, and related questions are taken up. The appendix among other matters contains a summary of data on the removal of stains from fabrics.

Chemistry of the household, Margaret E. Dodd (*Chicago: American School of Household Economics, 1905, pts. 1, pp. 1–55, figs. 15; 2, pp. 55–88, figs. 5; 3, pp. 89–122, figs. 12*).—A series of lessons on chemistry with special reference to the household designed for instruction by correspondence. Some of the subjects taken up are water, atmosphere, combustion, food and cookery, chemistry of cleaning and laundry work, and plant growth.

METEOROLOGY—WATER.

Climate [of Idaho] (*The State of Idaho. Boise: Bur. Immig., Labor, and Statis., 1905, pp. 154–157*).—A brief general description of the climate of Idaho, including tabular data for temperature and precipitation for different sections of the State during 1903. The annual mean temperature for 1903 was 45.1°, the highest temperature 110°, the lowest −37°. The total precipitation was 16.6 in., the total snowfall 57 in. The total precipitation for the different sections of the State varied from 10.93 in. in the southern section to 19.36 in. in the central section and 24.74 in. in the northern section.

An account of some features of the climate of Reno, Nevada, S. B. Doten (*Nevada Sta. Bul. 59, pp. 21, pls. 4*).—Meteorological observations on temperature, rainfall, snowfall, frost, and cloudiness which have been made at the Nevada State University since 1888 are summarized and discussed in their bearing on the climatic characteristics of the region.

Work of the station of agricultural climatology of Juvisy during 1904, C. Flammarion (*Bul. Mens. Off. Renseig. Agr. [Paris], 4 (1905), Nos. 7, pp. 780–793, figs. 7; 8, pp. 928–952, figs. 3*).—This report is of the same character as those of previous years (E. S. R., 16, p. 855). It contains tabular and diagrammatic records of the temperature of the air during each day and month of 1904, and of the annual and seasonal temperatures from 1885 to 1904; observations on barometric pressure, humidity, cloudiness, rainfall, direction of the wind, hours of sunshine, and solar radiation; a study of the diurnal and annual course of temperature for the climate of Paris, and of the diurnal variations of the temperature of the air.

The results of a study of the relation of the sun to vegetation and the action of different rays on vegetation and on silkworms are also reported, as well as the influence of the moon and of electricity on vegetation.

Meteorological observations, J. E. Ostrander and C. H. Chadwick (*Massachusetts Sta. Met. Buls. 201, 202, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1905. The data are briefly discussed in a general note on the weather of each month.

Meteorological summary for 1903–4, E. Burke (*Montana Sta. Rpt. 1904, pp. 237, 238*).—Monthly and annual summaries of observations on temperature, precipitation, cloudiness, prevailing winds, etc., for the year ended October 31, 1904. The mean temperature for that period was 41.2°, the highest temperature 89° August 14, the lowest −23° November 17. The total rainfall was 16.34 in., total snowfall 95 in., number of clear days 103, days on which 0.01 in. or more of precipitation occurred 89.

Meteorological summary for 1903, C. A. Patton (*Ohio Sta. Bul. 152, pp. 195–208*).—This summary includes notes on the weather and tabulated daily and monthly

records of observations at the station at Wooster, Ohio, on temperature, precipitation, cloudiness, direction of the wind, etc., and for comparison, similar data for previous years and for other parts of the State. The following is a summary of results:

Summary of meteorological observations in Ohio.

	For the experiment station.		For the State.	
	1903.	1888–1903.	1903.	1888–1903.
Temperature (° F.):				
Mean	49.1	49.2	50.5	50.8
Highest	(July 4 and 9) 94.0	(Aug. 8, 1891) 99.0	(July 25) 104.0	(July 4, 1897) 113.0
Lowest	(Feb. 19) −9.0	(Feb. 10, 1899) −21.0	(Feb. 19) −20.0	(Feb. 10, 1894) −39.0
Mean daily range	21.6	20.1		
Greatest daily range	(Nov. 18) 48.0	(Oct. 6, 1897) 55.0	(Sept. 25) 60.0	(Sept. 25, 1897) 67.0
Clear days	148.0	131.0		
Cloudy days	159.0	124.0		
Days rain fell	121.0	128.0	111.0	120.0
Rainfall (in.):				
Greatest monthly	(Aug.) 6.58	(July, 1896) 8.05		
Least monthly	(May) 1.59	(Sept., 1897) .29		
Mean yearly			39.87	37.26
Prevailing direction of wind	SW.	SW.	SW.	SW.

Annual precipitation in Oklahoma and Indian Territory, C. M. STRONG (*Oklahoma Sta. Rpt. 1905, pp. 60, 61*).—The total annual precipitation as observed at 25 places in Oklahoma is given for 1904 and 15 preceding years. A similar summary is given of observations at 11 places in Indian Territory. The average annual rainfall for Oklahoma varied from 38.93 in. at Lincoln to 16.34 in. at Beaver; for Indian Territory from 42.40 in. at South McAlester to 26.99 in. at Chickasha.

Meteorological observations on Ben Nevis, LORD MCLAREN ET AL. (*Rpt. Brit. Assoc. Adv. Sci., 1904, pp. 55–60*).—A brief account is given of a continuation of observations during 1903 at the low-level observatory at Fort William and the high-level observatory on Ben Nevis. (See also E. S. R., 15, p. 125.) The principal results arrived at are thus summarized:

"(1) When the difference of the mean temperatures of the day is only 12°, or less, the calculated sea-level pressure for the top of the mountain is markedly greater than at Fort William, and the accompanying meteorological conditions are anticyclonic, the weather being clear, dry, and practically rainless; (2) when the difference of temperature is 18°, or greater, the meteorological conditions are cyclonic, and the accompanying weather dull, humid, and rainy.

"The large result here arrived at empirically is in accordance with the principle laid down by Dalton, viz., that air charged with vapor or vaporized air is specifically lighter than when without the vapor; or, in other words, the more vapor any given quantity of atmospheric air has in it the less is its specific gravity.

"Another important result is that the cases of small differences of temperature between the two observatories are chiefly occasioned by an increase of temperature at the top of the mountain, and large differences of temperature by a decrease of temperature at the top.

"The intimate relation thus disclosed between the varying temperatures and sea-level pressures of a high-level and a low-level station is of prime importance in forecasting the weather, inasmuch as it reveals, in a way not hitherto attempted, the varying conditions of the hydrometric states of the atmosphere, particularly at high levels, upon which changes of weather so largely depend. The setting in of a process of saturation of the atmosphere at great heights may thus be made known, even when no cloud has yet been formed to indicate any such saturation. The important bearing of these results on such practical problems in meteorology as the forecasting of the monsoons of India is evident."

The rainfall and sunshine of Guernsey for the year 1904, A. COLLENETTE (*Guernsey Soc. Nat. Sci. Rpt. and Trans. 1904, pp. 391–399*).—Observations on rainfall at 9 stations are summarized and compared with the averages for 62 years. The total for the year was 37.72 in. as compared with an average of 36.62 in. for the past 62 years. A monthly summary of observations on sunshine during 1904 compared with similar data for the preceding 11 years is also given. The total sunshine for 1904 was 1,925.75 hours as compared with an average of 1,927.11 hours for the past 11 years.

Rainfall in the agricultural districts, G. G. BOND (*Queensland Agr. Jour., 16 (1905), No. 1, p. 152*).—A table is given which shows the total rainfall for each month from June, 1904, to June, 1905, inclusive, in 41 agricultural districts of Queensland.

Hourly observations of atmospheric phenomena at the Manila central observatory, 1903 (*Ann. Rpt. Philippine Weather Bur., 1903, pt. 1, p. 158, pls. 2*).—Detailed observations are recorded on pressure, temperature, precipitation, evaporation, humidity, direction and force of wind. There are also general notes on the weather conditions of the year.

The heaviest rainfalls in the world (*Jour. Mét. Russe, 1905, No. 1; abs. in Nature [Paris], 33 (1905), No. 1677, Sup., p. 25; Rev. Sci. [Paris], 5. ser., 4 (1905), No. 13, p. 408*).—It is stated that the heaviest recorded rainfall in the world occurs in Cherra Poonjee in the Indian Province of Assam. The mean annual rainfall of this region from 1895 to 1903 was 11.223 meters; that of the region of Bombay was 6.83 meters. The rainfall of Debundscha in Kamerun was 10.454 meters, principally during the summer. The highest recorded rainfall during any given year at Cherra Poonjee was 14.789 meters in 1851, at Debundscha 14.133 meters in 1902. At the latter place 456 mm. of water fell during a single day, June 16, 1902. These heavy rainfalls are explained as due to the proximity of warm seas and high mountains.

Weather conditions and statistics (*Ann. Rpt. Dept. Agr. Northwest Ter., 1904, pp. 7–22*).—This is a summary of observations during the year by the voluntary meteorological service of the Northwest Territories on temperature and precipitation, with notes on the general weather conditions during each month and the relation of crop yields and temperature and precipitation.

Forecasting the weather and storms, W. L. MOORE (*Nat. Geogr. Mag., 16 (1905), No. 6, pp. 255–305, pls. 5, charts 20*).—It is stated that this article is to constitute the first chapter of a treatise to be entitled *The New Meteorology*. After a brief historical note the preparation and use of the daily weather map is explained and illustrated.

A new method of determining the direction and velocity of storm movement devised by E. H. Bowie, which is claimed to be "a marked advance over anything heretofore accomplished in this direction," is fully described. The method is based upon a study of the pressure gradients about the base of the storm, in connection with the general drift of the upper air, thus making it possible "to obtain a resultant that approaches with close precision to the line of least resistance at the moment of the taking of the observations on which the weather chart is founded. In the majority of cases his system locates the place to which the storm center will move during the coming 24 hours with considerable accuracy."

Some aspects of modern weather forecasting, W. N. SHAW (*Abs. in Nature [London], 72 (1905), No. 1867, pp. 354, 355*).—In this address, delivered before the Royal Institution of Great Britain, the close relation existing between weather conditions and barometric distribution and changes is pointed out and some of the difficulties in the way of quantitative association of rainfall or temperature changes with barometric variations are discussed.

Islands for weather forecasting purposes, W. E. COOKE (*Nature [London], 72

(*1905*), *No. 1867*, *pp. 343*, *344*).—A discussion of the importance and value of Lockyer's suggestion regarding this subject (E. S. R., 17, p. 161) as applied to the meteorology of Western Australia.

Water and agriculture, L. Thiry (*Rev. Gén. Agron.*, *14* (*1905*), *Nos. 4*, *pp. 161–164; 5*, *pp. 198–206; 6*, *pp. 258–265*; *7–8*, *pp. 296–307*).—This is a general article treating of the rôle played by water in the life of plants and means of preventing injuries by drought, concluding with the statement that the future of Belgian agriculture depends in large part on the judicious use of water in irrigation.

Natural vegetation and the purity of waters, L. A. Fabre (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 13*, *pp. 537–539; abs. in Rev. Sci.* [*Paris*], *5. ser.*, *4* (*1905*), *No. 15*, *p. 466*).—It is stated that the purification of natural waters appears to be essentially a biological process.

The oxygen of the air is slowly carried down into the soil with the percolating waters and destroys by eremacausis the organic matter of the soil, at the same time increasing the vitality and multiplication of the aerobic organisms, which increase the fertility of the soil. The opposite effect, however, is produced on the pathogenic anaerobes. The latter, which are useless to plants, are eliminated or transformed after having lost their virulence into auxiliaries of the aerobes. Certain pathogenic races of organisms show a tendency to return to saprophytic types, which appear to be the original form of all micro-organisms in uncultivated soils.

Geology and underground water conditions of the Jornada del Muerto, New Mexico, C. R. Keyes (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 123*, *pp. 42*, *pls. 9*, *figs. 11*).—This bulletin deals with the general character of the New Mexican plateau region, and surface relief, formations, structure, and underground waters of the Jornada del Muerto. "It presents new and valuable information regarding the geologic structure of this large desert area, and shows that the conditions are favorable for the extensive occurrence of underground waters which, to some extent, are available for irrigation and domestic supplies. The region is one of fine climate and fertile soil, and the development of its underground waters will afford the means for sustaining settlers at a number of localities."

Water for domestic purposes in North Dakota, E. F. Ladd (*North Dakota Sta. Bul. 66*, *pp. 559–571*).—This bulletin discusses the standard of purity for potable waters, explains the significance of the results of analysis, and reports quantitative determinations of total, volatile, and nonvolatile solids, and chlorids, and qualitative tests for carbonates, sulphates, lime, magnesia, and soda in 160 samples of water from different parts of North Dakota. Few of the waters from deep artesian wells contained as little as 500 parts per million of solids, which has been recommended as the maximum limit for waters suitable for drinking purposes.

The city of Paris and the water question, L. Grandeau (*Ann. Sci. Agron.*, *2. ser.*, *10* (*1905*), *I*, *No. 3*, *pp. 342–401*, *figs. 2*).—This article first appeared as a series of letters to the *Temps*, of Paris, December, 1904, to May, 1905. It discusses mainly three conditions affecting the health of Paris as dependent upon the water supply, (1) the sewage contamination of the Seine, (2) the unsanitary condition of the sewer beds and farms due to their inability to properly dispose of the sewage brought to them, and (3) the lack of means of purifying the water supply derived from brooks and streams.

Sewage disposal by spreading it on the land, including sewage irrigation, is considered inadequate and unsatisfactory, and various other methods of disposal—the bacteriological process (using septic tanks and contact beds) and the Candy process (using sprinklers and "carboferrite" filters)—are discussed as possible substitutes or supplements. Accounts are also given of studies by Calmette on the biological purification of sewage. The causes and prevention of the contamination of the Seine are considered.

The means of correcting present conditions proposed are (1) extension of the area of the sewage farms, (2) substitution of bacteriological treatment for sewage irrigation, and (3) a combination of the two. The last seems to offer many advantages. An account of the Berlin sewage farm and its successful operation is given.

SOILS—FERTILIZERS.

The availability of potash and phosphoric acid in soil, G. S. FRAPS (*North Carolina Sta. Rpt. 1904, pp. 26–47*).—This article discusses and reviews investigations relating to the "influences which act to release the plant food locked up in the soil," grouping and defining these influences under three "factors of availability," viz, (1) chemical availability, (2) physical availability, and (3) weathering availability. These should take into account "the amount of plant food which is present in forms of combination that can be taken up by the plant; the physical condition of the soil; the amount of plant food converted into assimilable forms during the period of growth of the plant; the feeding power of the plants."

A study of the changes caused by weathering and by varying conditions of moisture, organic matter, and calcium compounds in 3 typical North Carolina soils is reported. The results show that "nitric acid of 1/50 normal strength dissolved from 40 to 80 per cent as much potash as 1/5 normal nitric acid from samples (differently treated) of one soil, and from 50 to 90 per cent from another. The amount of phosphoric acid soluble in 1/5 normal nitric acid may increase or decrease in a moist soil after standing 4 months, but increases if calcium sulphate is present. An increase in the amount of potash soluble in 1/5 normal nitric acid took place in a soil kept moist 4 months, with or without the presence of calcium sulphate.

"The presence of calcium carbonate had a tendency to decrease the amount of potash dissolved. There was a difference in the behavior of the three soils, one showing a tendency to decrease in soluble potash, while the other two increased. In the same samples the quantity of potash soluble in 1/50 normal acid had decreased. The effect of moist calcium carbonate was to reduce the solubility of phosphoric acid in 1/5 normal acid as compared with dry calcium carbonate. In one soil calcium carbonate increased decidedly the amount of phosphoric acid soluble in 1/5 normal acid, and in two soils it decreased the amount. It caused a decrease in the amount of soluble potash in every case. Calcium sulphate increased the amount of phosphoric acid soluble in 1/5 normal acid, particularly in one of the soils. It caused a decrease in the solubility of potash in two cases and a decided increase in one.

"There is no contradiction in the fact here brought out that calcium salts decrease the amount of potash dissolved by 1/5 normal or 1/50 normal nitric acid, and the fact that calcium salts cause more potash to go into solution in an aqueous extract of the soil—'liberates potash.'

"The decay of organic matter (starch or sawdust) in a soil caused a decrease in the amount of phosphoric acid dissolved, but a great increase in the amount of potash, from 20 to 99 per cent with 1/5 normal acid, and from 11 to 20 per cent with 1/50 normal acid. . . .

"There was a variation in the power of soils to convert organic matter into humus and retain it. In three soils, the amount of humus gained from starch at the end of 6½ months was 0.0, 0.06, 0.18; and from sawdust 0.03, 0.14, 0.30 per cent of the ignited soil. A relatively small amount of organic matter added to soils was converted into humus. The maximum obtained in this work was 3 per cent of the starch and 4.1 per cent of the sawdust, though from 75 to 95 per cent of the starch and from 30 to 37 per cent of the sawdust disappeared during the 4 months."

On the source, amount, and importance of carbon dioxid in soil, J. STOKLASA and A. ERNEST (*Centbl. Bakt.* [*etc.*], *2. Abt., 14 (1905), No. 22–23, pp. 723–736; abs. in Chem. Ztg., 29 (1905), No. 68, Repert. No. 17, p. 249; Jour. Chem. Soc.* [*Lon-*

don], *88* (*1905*), *No. 515, II, p. 607*).—It is stated that the principal sources of carbon dioxid in the soil are micro-organisms and the roots of the higher plants.

The results of studies by means of special apparatus of the rate of production of carbon dioxid by micro-organisms and the roots of plants are reported and from them it is estimated that the organisms in 1 hectare of soil to a depth of 40 cm. produce 75 kg. of carbon dioxid per day during the 200 days a year on which the temperature reaches a mean of 15° C. Assuming that a hectare of soil bears 2,000,000 plants of a cereal, the production of carbon dioxid by their roots would, according to the results reported, be 60 kg. per hectare daily. Of the plants experimented with, red clover, beets, and oats produced the largest amounts of carbon dioxid.

It is claimed that the large amounts of carbon dioxid derived from these sources convert a notable amount of soil material into soluble forms. It is held that the solvent action of roots, especially young roots, is due to this carbon dioxid and not to organic acids, which, as Czapeck and Kohn and Kossowich have shown (E. S. R., 16, pp. 344, 1048), are not secreted by plants.

Contributions to our knowledge of the aeration of soils, F. H. KING (*Science, n. ser., 22* (*1905*), *No. 564, pp. 495–499*).—A review of Bulletin 25 of the Bureau of Soils (E. S. R., 16, p. 752), claiming that a weakness of the conclusions drawn lies in the fact that they are based upon "the mathematical treatment of a very limited series of laboratory experiments, which, however, have been executed with great care," but have not been checked by field observations and experiments. It is maintained "that rates of transpiration, as measured in the laboratory trials, are quite inapplicable for use in giving a measure of the rate of flow of air through soils under field conditions."

The influence of packing of the soil on the growth of oats, C. VON SEELHORST and KRZYMOWSKI (*Jour. Landw., 53* (*1905*), *No. 3, pp. 269–278*).—The observations recorded indicate that rolling hinders the growth of plants by interfering with transformation of nitrogen in the soil and with root breathing. The influence of rolling on the lodging of cereals is discussed.

Bare fallow, C. VON SEELHORST (*Deut. Landw. Presse, 32* (*1905*), *Nos. 71, pp. 601, 602; 72, pp. 608–610; 73, pp. 615, 616*).—A review of evidence showing, as Pfeiffer claims (E. S. R., 16, p. 858), that bare fallowing is soil robbery and is as a rule bad practice on ordinary soils (not containing an excess of organic matter).

Investigations on evaporation from cultivated soils and from uncultivated stubble soil, C. VON SEELHORST (*Jour. Landw., 53* (*1905*), *No. 3, pp. 264–268*).—Observations on large vegetation cylinders are reported which indicate that in case of heavy rainfalls more water evaporates from hoed soil than from unhoed, but that with small rainfalls the reverse is true.

Investigations on the percolation of rain water in sandy and loamy soils, C. VON SEELHORST (*Jour. Landw., 53* (*1905*), *No. 3, pp. 260–263*).—Observations on vegetation cylinders of 1¼ cubic meter content showed no great difference in the amount of evaporation on sand and medium loam soil whether fallow or stubble.

Some agricultural and geobotanical observations, S. KRAVKOV (*Zeml. Ghaz., 1904, Nos. 46, 47; abs. in Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6* (*1905*), *No. 1, pp. 24–26*).—One of the observations relates to the water-soluble salts in the soil. The concentration of the soil solutions was found to vary greatly according to the weather, the properties of the soil, the relief of the locality, and other conditions. It was noted that a field apparently uniformly cultivated and with a uniform cover of living plants and plant remains showed very different amounts of substances soluble in water at points close to one another. Such fluctuations the author ascribes to differences in thickness of the plant cover, to the influence of animals, etc. During the winter the soil solution remained almost unaltered; in the spring there was in the drained soil a washing out or accumulation of dissolved substances according to the character of the weather until a sufficient plant covering grew up, when

the concentration was maintained at a certain level; in the less active, undrained soil the conditions of concentration were reversed.—P. FIREMAN.

Distribution of the population of Sweden as determined by the geological character of the soil, C. RABOT (*Géographie, 11 (1905), No. 5, pp. 359–367, figs. 6*).

The sugar-cane soils of Jamaica, III, H. H. COUSINS (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 7, pp. 137–146*).—This is a third communication on this subject (E. S. R., 15, p. 459) and reports mechanical and chemical analyses of 12 samples of soil with brief discussions of the fertilizer requirements of the different samples. The most striking characteristic common to all the soils was the deficiency of calcium carbonate. "In some cases it was not possible to detect any carbonates at all."

Geological notes on cacao soils, E. H. CUNNINGHAM-CRAIG (*Trinidad Bot. Dept., Bul. Misc. Inform., 1905, No. 47, pp. 196–200*).—The 8 principal rocks that have been observed as forming cacao-bearing soils are noted, the soils themselves are described, and suggestions are given regarding the kinds of fertilizers which should be used on the soils of different origin in the culture of cacao.

Investigations in regard to the phosphoric acid in cultivated land in Java, T. MARR (*Meded. Proefstat. Oost-Java, 4. ser., No. 4, pp. 65–87, figs. 2*).—Many Java soils present the peculiarity of producing good crops and failing to respond to applications of phosphates, although containing less total phosphoric acid than is generally considered necessary for a productive soil (0.1 per cent). The assimilable phosphoric acid was determined in some of these soils by Schloesing's method of digestion in dilute (0.01 to 0.1 per cent) nitric acid (E. S. R., 11, p. 131), and Dyer's method of digestion in citric acid (E. S. R., 5, p. 1013), using, however, 2 per cent acid. The first method showed much less available phosphoric acid (0.0017 to 0.0234 per cent) than is considered by de Sigmond (E. S. R., 12, p. 907) necessary for a productive soil, viz, 0.075 per cent. With Dyer's method, however, the available phosphoric acid was, as a rule, higher (with one exception 0.018 to 0.071 per cent) and well over the limit set by Dyer for a productive soil, viz, 0.01 per cent. There was little or no relation between the total phosphoric acid and that found by either of the above methods.

Investigations on the potash content of moor soils, P. VAGELER (*Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 2 (Ergänzungsh.), Sup. 1, pp. 125–133*). The averages of 143 analyses of cultivated Bavarian moor soils are reported showing a variation in potash content of from 0.0544 per cent to 0.089 per cent. The average amount of potash in virgin upland moor soil was 0.033 per cent. In spite of the fact that most of these soils are well supplied with potash, they are much benefited by liberal applications of potash fertilizers. The potash is apparently in very unavailable form.

The soil of the Pontine marshes, A. ORTH (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 741–745*).—Analyses of several samples of soil are reported and the character of the soils of the Roman Campagna is discussed.

On the difficulty of ascertaining the productiveness of tropical soils, A. COUTURIER (*Bul. Assoc. Chim. Sucr. et Distill., 22 (1905), pp. 1302–1304; abs. in Chem. Centbl., 1905, II, No. 11, pp. 849, 850*).—The author points out that the climatic agencies which have resulted in the formation of tropical and subtropical soils bring about a very different series of physical and chemical changes from those which take place in the soils of temperate zones. Tropical soils therefore can not be judged on the same basis as soils of temperate zones. For this reason there is great need of careful study of tropical soils.

Soil analysis and the value of the results in the fertilizing of vineyards, A. HUBERT (*Monit. Sci., 4. ser., 19 (1905), II, pp. 582–588; abs. in Chem. Centbl., 1905, II, No. 9, p. 695*).—Descriptions are given of the methods used, which were in the main the official methods of the committee of French agricultural experiment stations. Directions for fertilizing based upon analyses of various vineyard soils are

given and the value of chemical analyses in determining the fertilizer requirements of soils pointed out.

A new method of mechanical soil analysis, A. SABANIN (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 896–898*).—A method involving the use of small amounts of soil (3.75 to 4 gm.) and based upon boiling in a small Erlenmeyer flask, passing through sieves, and allowing to settle in cylinders, is briefly described.

The bacteriological examination of cultivated soils, T. REMY (*5. Internat. Kong. Angew. Chem., 1903, Ber. 3, pp. 784–794*).—Comparative studies of the behavior of different soil organisms under varying conditions are reported.

Soil inoculation (*Jour. Bd. Agr. [London], 11 (1905), No. 11, pp. 669–673*).—In a previous publication (E. S. R., 16, p. 541) an account was given of experiments with the improved Nitragin for the inoculation of leguminous crops. In the present report a description is given of the methods of application and a comparison is drawn between this improved inoculating material and that distributed by this Department.

As formerly, the Nitragin is prepared for special crops, cultures being now available for beans, clovers of various kinds, alfalfa, vetches, etc. The cultures are distributed in glass tubes and must be protected from heat and too much light. The contents of the tubes are to be turned out into water, or better still, fresh milk, and nutrient substances, said to be peptone and grape sugar, are dissolved in the solution before adding the culture. The seeds to be inoculated are wet with the solution and sown at once, care being taken to prevent their drying. Nitragin differs from the material prepared by this Department in that it must be prevented from drying, while the inoculating material of this Department is sent out in a dry condition and may be allowed to dry on the seed. The other methods of handling are quite similar for the two substances.

Contribution to the knowledge of nitrogen bacteria, F. LÖHNIS (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), Nos. 18–20, pp. 582–604; 22–23, pp. 713–723; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 515, II, pp. 601, 602*).—This is a review of the investigations by the author during several years past, as well as of similar studies by other investigators on nitrogen-fixing bacteria, bacteria which assimilate nitrates, and urea bacteria.

The principal organisms in these 3 classes are described, and it is shown that the various nitrogen-fixing bacteria (*Bacterium pneumoniæ, B. lactis viscosum, B. radiobacter, B. radicicola, B. prodigiosum,* and *B. turcosum*) also assimilated nitrates, but to different extents. *B. agreste* did not fix nitrogen but assimilated nitrates vigorously, while *B. fluorescens* decomposed nitrates chiefly by denitrification. In cultures inoculated with soil urea was rapidly converted into ammonium carbonate, probably by the action of *Urobacillus pasteurii*, but attempts to isolate this micro-organism were unsuccessful.

The characteristics and behavior in cultures of *Bacillus freudenreichii* are described. This organism showed but small capacity for transforming urea into ammoniacal compounds.

On the value of some new nitrogenous fertilizers, H. G. SÖDERBAUM (*Meddel. K. Landtbr. Akad. Exptlfält. [Stockholm], No. 85, pp. 27*).—The author discusses a number of new methods of utilizing the nitrogen of the air for agricultural purposes, and gives an account of pot and field experiments with 2 new fertilizers at the experiment station at Albano, Sweden, viz., with calcium cyanamid and calcium nitrate.

The former fertilizer produced an increase in the yield of white mustard of 52.9 per cent of that of an equivalent amount of nitrogen in nitrate of soda. In experiments with oats in vessels buried in the ground, the yield obtained with calcium cyanamid was to that obtained with nitrate of soda as 76:100. The increase in the straw was, however, relatively larger than in grain.

Pot experiments with oats showed that calcium cyanamid produced yields of grain from 86.1 to 102.7 per cent of those obtained with similar amounts of nitric nitrogen, the total increase in the yields of grain and straw ranging from 86.1 to 98.3 per cent. Ammonium sulphate in the same series of trials produced an increase of 95.9 to 101.7 per cent in the total crop, and of 98.9 to 102.7 per cent in the yield of grain, the yields obtained with equivalent amounts of nitrate of soda being placed at 100. Similar results were obtained in field experiments with oats.

When applications of calcium cyanamid containing 150 kg. of nitrogen per hectare (134 lbs. per acre) were made directly before sowing, a decided poisonous effect was produced in the case of mustard, while similar applications added 11 days before sowing oats produced no symptons of poisoning whatever. Pure calcium nitrate produced approximately the same increase in the yield of oats as equivalent amounts of nitrate of soda when grown in pots or in plat experiments.

The effect of the presence of nitrites in calcium nitrate was studied in a series of experiments with oats, nitrate containing different quantities of nitrite, viz, from 1 to 20 per cent, being applied. It was found that such impure nitrate produced fully as good, if not better, results than nitrates free from nitrites, the increase in yields of total crop on the former fertilization ranging from 113 to 120 per cent of those obtained on the latter fertilization, and in yield of grain from 108 to 113 per cent. A bibliography of the subject is given at the end of the report.—F. W. WOLL.

Preservation and action of the nitrogen of urine, E. BÖHME (*Illus. Landw. Ztg., 24 (1904), Nos. 87, pp. 1001, 1002, figs. 3; 88, p. 1011, figs. 7; 89, pp. 1023–1025, figs. 5; abs. in Centbl. Agr. Chem., 34 (1905), No. 5, pp. 300–305; Jour. Chem. Soc. [London], 88 (1905), No. 513, II, p. 477*).—In the experiments reported gypsum, used at the rate of 10 per cent, reduced the loss of nitrogen to 7 per cent in 250 days, untreated urine losing 56 per cent of its nitrogen in that time. Sulphuric acid (1 per cent) reduced the loss to 5.5 per cent, while 2 per cent of sulphuric acid retained all of the nitrogen.

Addition of lime and gypsum increased the action of the urine when used as a fertilizer. Urine treated with these substances and with sulphuric acid gave better results when applied before seeding than as a top-dressing. The nitrogen of the urine was almost equal in effect to that of sodium nitrate.

Ammoniacal nitrogen as a plant food, GERLACH and VOGEL (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 3–4, pp. 124–128, figs. 2; abs. in Chem. Centbl., 1905, I, No. 24, p. 1609*).—Parallel experiments were carried out in sterilized soil in pots of special construction to test the comparative effect of ammoniacal nitrogen (ammonium sulphate) and nitric nitrogen (sodium nitrate) on the corn plant.

Notwithstanding the fact that no nitrous or nitric organisms were present and no nitrites or nitrates were formed in the soils to which ammonium sulphate was added, the yields of dry matter and the nitrogen content of both the above ground and below ground parts of the plants were markedly increased. The yields of dry matter and nitrogen content per pot were, respectively, 55.42 and 0.189 gm. without application of nitrogen; 80.88 and 0.445 gm. with sodium nitrate; and 72.54 and 0.387 gm. with ammonium sulphate. These results indicate that the maize plant can take up and use the nitrogen of ammonium sulphate without nitrification.

Ammonium salts or nitrate of soda, CLAUSEN (*Deut. Landw. Presse, 32 (1905), No. 72, pp. 611, 612*).—An account is here given of experiments during 1904 with oats on a moderately loamy sandy soil to determine the relative effect of ammonium salts and nitrate of soda on dry and moist soils, one series of plats receiving only the natural rainfall, another being kept moist by irrigation until 3 leaves had appeared, and a third kept moist until the time of harvest.

The nitrate of soda gave the best results on the unirrigated soil, but was less effective than the ammonium salts in the other 2 cases. The lower efficiency of the nitrate, however, was apparently not due to washing of nitrates into the drainage,

since the plat receiving the larger amount of water gave a larger yield with nitrate of soda than that receiving the smaller amount.

Nitrate by-product, AUMANN (*Abs. in Centbl. Agr. Chem., 33 (1904), No. 12, p. 852*).—A product obtained by the evaporation of water from the holds of ships carrying nitrate of soda is found on the market under the name of nitrate by-product. It consists largely of common salt, but contains small amounts of potash and 3 to 4 per cent of nitrogen corresponding to 18.2 to 24.3 per cent of nitrate of soda. Attention is called to a spurious article, consisting almost entirely of salt, which is being sold under the same name.

Calcium nitrate in agriculture, E. S. BELLENOUX (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 18, p. 1190; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 513, II, p. 478*).—Comparative tests of sodium and calcium nitrates on potatoes and sugar beets are reported which show an increase of 1.8 per cent of starch in the potatoes and 1.37 per cent of sugar in the beets in favor of the plats fertilized with calcium nitrate as the average of several years' experiments. The calcium nitrate is prepared by the action of sodium nitrate on calcium chlorid, the sodium chlorid separating out on concentration.

On some constituents of Manchester soot, E. KNECHT (*Mem. and Proc. Manchester Lit. and Phil. Soc., 49 (1905), pt. 3, No. 14, pp. 10; Chem. News, 91 (1905), No. 2376, pp. 259–261*).—A detailed study is reported from which the following averages are estimated: Ammonium sulphate 10.7, ash 19.6, acid constituents 10.9, and hydrocarbons (benzene extract) 13 per cent.

The Tunisian phosphates, L. PERVINQUIÈRE (*Rev. Sci. [Paris], 5. ser., 4 (1905), No. 12, pp. 353–361, figs. 3*).—An account is given of the discovery, character, and exploitation of these phosphates, especially the very rich deposits of Gafsa. Analyses reported show these phosphates to contain from 60 to 66 per cent of tricalcium phosphate, 10 to 15 per cent of calcium carbonate, and 1.25 to 2.50 per cent of alumina and iron oxid.

On the action of organic acids on phosphates, A. QUARTAROLI (*Staz. Sper. Agr. Ital., 38 (1905), No. 1–2, pp. 83–113; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 514, II, p. 549*).—A series of studies is reported which leads to the conclusion that the organic acids which usually occur in plants first render insoluble phosphates soluble and then convert them into dihydrogen phosphates. Any free phosphoric acid which may be produced is converted in the plants into a dihydrogen salt. This is explained by the lower acidity of organic acids as compared with phosphoric acid and by their greater affinity as compared with acid phosphates.

Potash for mangolds and potatoes on moor soils, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 2, pp. 91–100, pls. 4, fig. 1*).—The author conducted experiments with mangolds and potatoes in vegetation vessels placed in ground of 1 square meter surface area.

The most economical results in fertilization of these crops with potash on moor soils were obtained by applying the high-grade salts. It was found, and is plainly shown by lithographic reproductions of the crops grown under different systems of fertilization, that abnormal changes in the vegetative parts of these crops appeared whenever the soil was in marked need of potash.—F. W. WOLL.

Fertilizer experiments with lime, M. HOFFMANN (*Arb. Deut. Landw. Gesell., 1905, No. 106, pp. XIV+276, figs. 2*).—This article discusses the chemistry of lime and reports in detail a series of experiments made from 1899 to 1903 on 150 farms in 17 different regions of the German Empire under the auspices of the fertilizer section of the German Agricultural Society, cooperating with local societies or experiment stations.

Of the 150 experiments undertaken only 79 were properly carried out according to the five-year plan which included one crop of legumes and 2 of potatoes, but excluded bare fallow.

In the majority of cases applications of lime were beneficial. On light soil poor in humus and in dry seasons, however, the carbonates proved preferable to the more caustic quick lime. Practical deductions regarding methods of application of different forms of lime are drawn.

The injurious effect of gypsum in vegetation experiments in zinc pots, D. Meyer (*Fühling's Landw. Ztg., 54 (1905), No. 8, pp. 261–267*).—Previous experiments having shown that applications of gypsum resulted in a decrease in yield in the case of certain crops grown in zinc pots on a soil composed of sand and 2½ per cent of peat, further experiments were undertaken to determine the cause and extent of this action, as well as the behavior of different crops grown under such conditions.

Parallel experiments in zinc pots and in earthenware pots showed that the yields were uniformly larger in the latter, but that different plants vary widely when grown under the same conditions. The decline in yield following applications of gypsum in zinc pots was especially marked in the case of leguminous plants. The injurious effect of the gypsum was overcome by applying with it a certain amount of calcium or magnesium carbonate, and was not observed when the artificial soil mixture was made up of sand and 10 per cent of ordinary field soil.

Further experiments are considered necessary to determine the exact cause of the injurious effect of the gypsum and the behavior of different crops toward this substance under varying conditions.

On the injurious action of gypsum in vegetation experiments in zinc pots, B. Tacke (*Fühling's Landw. Ztg., 54 (1905), No. 10, pp. 331, 332*).—A brief note on Meyer's article referred to above.

The author calls attention to the earlier work of Fleischer [a] and Tacke and Immendorff [b] with gypsum on acid upland moor soils, which indicated that the injurious effect of gypsum observed, especially in the case of leguminous plants, was due to the setting free of acids to which such plants are especially sensitive. A similar explanation is offered for Meyer's results, the injurious effect of the gypsum being heightened in the case of the zinc pots by the action of the zinc dissolved by the free acids, [c] as indicated by the author's experiments on acid moor soils.

Some of the more recent investigations on the use of commercial fertilizers, Rippert (*Fühling's Landw. Ztg., 54 (1905), No 18, pp. 608–620*).—A review of investigations relating especially to the comparative fertilizing value of nitrogen in form of ammonia and nitrate and of different forms of phosphates and potash salts.

It is pointed out that in judging of the efficiency of a given fertilizer account must be taken of a number of different factors, including geographical position, climate, amount of precipitation, geological character of the soil, chemical and physical properties, depth of the surface soil, as well as the character of the subsoil.

The investigations discussed include experiments by Kruger, Klöpfer, and Schneidewind on the comparative fertilizing value of ammonium salts and nitrates used alone or in mixture with peat or soil and applied as top dressing or mixed with the soil (E. S. R., 15, p. 130; 16, p. 554); experiments at Lauchstädt on the use of phosphoric acid in connection with manure of various kinds, and on the relative value of Wolters phosphate, superphosphate, and Thomas slag (E. S. R., 16, p. 654); and experiments by Schneidewind, Meyer, and Wagner on the comparative value of potassium sulphate, potassium chlorid, 40 per cent potash salt, and kainit, as well as on the influence of the associated salts in potash fertilizers (E. S. R., 16, pp. 660, 760, 861).

Analyses and valuations of commercial fertilizers, J. P. Street, W. P. Allen, and V. J. Carberry (*New Jersey Stas. Bul. 187, pp. 21*).—Analyses of 232 samples of

[a] Landw. Jahrb., 1891, p. 607.

[b] Mitt. Förd. Moorkultur, 1899, p. 175.

[c] Landw. Jahrb., 27 (1898), Ergänzungsh., IV, p. 259 (E. S. R., 10, p. 941).

fertilizers, representing 96 manufacturers, are reported with a schedule of trade values of fertilizing materials for 1905.

Analyses of commercial fertilizers, H. J. WHEELER ET AL. (*Rhode Island Sta. Bul. 108, pp. 12*).—"This bulletin contains the results of such analyses of bone, tankage, and of ready-mixed potato fertilizers as have been found on sale in Rhode Island during the spring of 1905."

Analyses of commercial fertilizers (*South Carolina Sta. Buls. 110, 111, 112, 113, pp. 4 each*).—Tabulated analyses of 160 fertilizers.

Fertilizer analyses, fall season, 1904, to spring season, 1905, B. W. KILGORE (*Bul. N. C. Bd. Agr., 26 (1905), No. 7, pp. 77*).—The names and guaranteed composition of fertilizers registered for 1905, and analyses and valuations of 679 samples of commercial fertilizers and 108 samples of cotton-seed meal, examined during the fall of 1904 and spring of 1905, with explanations regarding terms used in fertilizer analyses, freight rates, valuation, etc.

Mineral products of the United States, calendar years 1895 to 1904, D. T. DAY (*U. S. Geol. Survey, 1905, Aug., folio*).—The quantity and value of the different products during the years named are given. Among the products of special interest from an agricultural standpoint are gypsum, of which 940,917 short tons, worth $2,784,325, were produced in 1904; marl, 25,000 short tons, worth $20,000; and phosphate rock, 1,874,428 long tons, worth $6,873,625.

Working in Great Britain of the fertilizers and feeding stuffs act, 1893 (*Minutes of Evidence before Dept. Com. Bd. Agr. and Fisheries [London], 1903, pp. III+236*).—A detailed report of evidence, a summary of which was noted in E. S. R., 16, p. 961.

AGRICULTURAL BOTANY.

Report of the botanist, J. W. BLANKINSHIP (*Montana Sta. Rpt. 1904, pp. 219–224*).—An account is given of the various lines of investigation carried on by the author during the period covered by this report. A considerable portion of his time was given up to the study and determination of the botanical collections that have been made, and some work was done in collecting, naming, and mounting parasitic plant disease material, with the hope of getting together sufficient material for a publication on the parasitic diseases of the State.

A brief account is given of a disease of cottonwoods which seems to be of an infectious nature and which attacks the different species of cottonwood growing in a number of the largest cities of the State. The same species in the wild state do not seem to be affected. The principal symptom of disease is the yellowing of the foliage accompanied by bleeding from the limbs and trunks, and when cut the wood shows a diseased condition of the tissues extending downward from the points where the bleeding takes place. The author suggests the name "cottonwood yellows" for this disease, and its diagnosis and treatment are to be the subject of further investigation.

In cooperation with the horticulturist, collections have been made of a number of plants to test their adaptability for ornamental cultivation. Notes are also given on a number of introduced plants that threaten to become troublesome as weeds, etc.

The physiological effects of Bordeaux mixture, R. SCHANDER (*Landw. Jahrb., 33 (1904), No. 4–5, pp. 517–584; abs. in Jour. Bd. Agr. [London], 12 (1905), No. 7, pp. 413–416*).—After discussing the effect of copper on plants and the use of Bordeaux mixture as a fungicide, the author gives an account of an extended series of experiments to test the effect of Bordeaux mixture upon the host plant, wholly aside from its action as a fungicide.

The various theories regarding the supposed stimulating effect of Bordeaux mixture are reviewed, and the author rejects the idea of a stimulating effect acting through

the epidermis of the leaves, stating that wherever the copper penetrates the cuticle it acts injuriously upon the protoplasm of the leaf cells. The copper left in the soil as a result of repeated sprayings can not be other than injurious to the plant, especially if present in appreciable quantity.

The beneficial action of this fungicide is attributed to a number of factors, the principal of which are the action of the lime, the repression of many insects by spraying, and the influence of a thin coating of copper on the assimilation and transpiration of the plant. The latter of these factors is believed to be the most important, and to it much space is given. The author considers that the thin coating of copper hydrate on the leaves protects the chlorophyll against the injurious action of too intense light and diminishes the transpiration of the leaves. No chemical action takes place, the beneficial results being due solely to the physical action of the thin layer of copper in reducing the intensity of light. As a practical application of this theory, it is suggested that the strength of Bordeaux mixture might be regulated to suit the character of the season, exposure, etc.

Attention is called to the occasional injury to foliage and fruit from the use of Bordeaux mixture. This seems due in many instances to the use of too little lime in making the fungicide, but similar results have been observed when there was an excess of lime used. The amount of injury seems to vary for different plants, and it is influenced by different climatic conditions. In general the excess of lime seems to check the injurious effects of copper sulphate, but in the case of apples and peaches it is not wholly able to prevent it, and in addition a superabundance of lime very greatly reduces the adhesiveness of the fungicide. The excess of lime is also associated with a reduction in the amount of copper hydrate, and, as a consequence, its fungicidal action is diminished.

The author inclines to the belief that in practice it will be found best to use equal weights of lime and copper sulphate. There appears to be no reason for not following this proportion in spraying grapes, apples, pears, and potatoes. For spraying peaches 2 parts of lime to 1 part of copper sulphate should be employed, and the number of applications should be as limited as possible, sprayings never being made during rainy or cloudy weather.

Notes on water transfer in plants, H. H. DIXON (*Sci. Proc. Roy. Dublin Soc., n. ser., 11 (1905), No. 2, pp. 7-12*).—In considering the possibility of the participation of living cells of the stem of a plant in the elevation of the transpiration current, the author has reviewed the experiments of Ursprung, who concluded that the cells assist by directly elevating the water or partially supporting a hydrostatic head, and by keeping the vessels and tracheids in a condition suitable for transmitting water. The author carried on experiments with living stems and attached leaves, and he gives quite a different interpretation of the results obtained.

When portions of the stem were killed by heat the leaves beyond wilted, indicating that the cells of the stem exercised no especial function in the elevation of water. Where only very short portions of the stem were killed little injury appeared, but when 2 to 5 cm. of the stem was killed the leaves showed injury in proportion to the length of stem destroyed. This injury had a progressive effect, which is attributed to the introduction into the leaves of poisonous or plasmolyzing substances from the dead cells. This action was repeatedly shown by immersing freshly cut stems in decoctions made by boiling stems of the same kind and cooling the fluid. As compared with stems immersed in fresh water, wilting took place much earlier with those immersed in the decoctions.

In order to show that this effect was not due to clogging, the bottom of the immersed stems was cut off at frequent intervals, and the injurious properties of the decoctions were retained after repeated filterings. Some slight injury may have been due to clogging of the water-conducting tissues of the plant by comparatively impermeable substances, but the filtering would have removed most of these. It is

possible that the application of heat in these experiments may to some extent have permanently interrupted the water supply by breaking the water columns, on the continuity of which the water supply of the aerial portions depends.

On the movements of petals, Esther P. Hensel (*Univ.* [*Nebr.*] *Studies, 5* (*1905*), *No. 8, pp. 38*).—A report is given of an investigation of the physical causes which bring about the opening and closing movements of certain flowers. In this investigation experiments were carried on with the dandelion, four o'clock, morning glory, evening star, evening primrose, and flax, and observations made upon a large number of other flowering plants.

It is shown that the opening of the dandelion flowers can be controlled by keeping the flowers at a lower temperature than normal, and when the opening has been retarded they can be caused to open by the application of either dry or moist heat. It was found possible to close any ephemeral flower before its time by an extra amount of heat, either moist or dry. It is impossible to open an ephemeral flower by placing the plant in a lower temperature, since this checks growth, and opening with this type is a matter of growth rather than one of stimulus.

In the study of the different plants, light, humidity, and water content of the soil were eliminated as possible physical factors, and it was found that heat, by its variations during 24 hours, is the direct cause of movement in those types of flowers that bloom for more than one day. The closing of ephemeral flowers can be delayed several hours by a temperature which is constantly lower than normal. The cause of the periodic movements of flowers lasting more than a single day is attributed to the influence of variations of temperature, acting not through turgescence, but by stimulation of the protoplasm.

A preliminary report on the Hymeniales of Connecticut, E. A. White (*Conn. State Geol. and Nat. Hist. Survey Bul. 3, pp. 81, pls. 40*).—The author gives a list, together with descriptive and critical notes, of the fleshy and woody fungi known to occur within the State of Connecticut. The aim has been to compile as far as possible a complete and accurate list of native species rather than to prepare original keys, technical descriptions of species, etc.

Notes on amanitas, W. A. Kellerman (*Mycol. Bul., 3* (*1905*), *Nos. 41, pp. 161–164, figs. 3; 42, pp. 165–168, figs. 3*).—Illustrated notes, technical descriptions, and general accounts are given of a number of species of Amanita, of which *A. verna* and *A. solitaria* are figured and described. Both of these species are said to be highly poisonous.

A yellow race of Bacillus pseudarabinus from the quince, R. G. Smith (*Proc. Linn. Soc. N. S. Wales, 29* (*1904*), *pt. 4, pp. 860–862*).—While making a study of the bacterial flora of some branches of quince a number of species were collected, one of which appeared in great abundance and was made the subject of considerable investigation

The general morphology of the organism seemed to indicate that it was closely related to *Bacillus pseudarabinus*, except that the bacterium from the sugar cane was always white while that from the quince was yellow, varying from a pale buff on gelatin to a deep yellow on potato. Further study convinced the author that there are no specific differences in the organisms but that they are white and yellow races of the same species.

The bacterial origin of Macrozamia gum, R. G. Smith (*Proc. Linn. Soc. N. S. Wales, 29* (*1904*), *pt. 4, pp. 863–868*).—In continuation of his investigations on the bacterial origin of certain gums, the author reports the isolation from *Macrozamia spiralis* of a species of bacillus to which the name *B. macrozamiæ* is given. The morphology of the organism and the characteristics of the gum it forms are described.

FIELD CROPS.

Variety tests of grains, A. ATKINSON (*Montana Sta. Rpt. 1904, pp. 210–217*).—The average results obtained at the station with 23 varieties of spring wheat, 16 of barley, and 14 of oats grown on one-sixtieth acre plats from 1900 to 1904, inclusive, are given in tables.

Nineteen varieties of wheat gave an average yield of 50 bu. or more per acre, the 5 leading varieties and their yields being as follows: Kubanka, 59.9; Glyndon 692, 59; Glyndon 650, 58.7; Glyndon 715, 56.8; and Russian 2955, 56.3 bu. per acre. Wild Goose ranked first with an average weight of 62.4 lbs. per bushel. The latest varieties, Glyndon 768, Boulton blue stem, and Red fife, required 127 days to mature, and Bart Tremenia and Pringle Champion, the earliest sorts, 120 days.

New Zealand, a 2-rowed barley, gave uniformly good results during the 5 years and ranked first with a yield of 82.5 bu. per acre. Berkeley, a 2-rowed beardless variety, stood last in yield with an average of 46 bu. per acre, and also in weight per bushel with 51.4 lbs. Guy Mayle, a hulless variety, gave an average weight of 64.6 lbs. per bushel, standing first in this regard. No. 5590, obtained from this Department, gave the second largest yield, averaging 77.7 bu. for 4 years, and Mandscheuri, California Prolific, Italian, Manhattan, and Improved Cheyenne produced over 70 bu. for the 5 years.

Fourteen varieties of oats ranged in average yields from 101 to 123.5 bu. per acre, with Progress, Wide Awake, and Improved American as the leading sorts. Swedish Select, not included in this test, produced 133.4 bu. per acre in 1904. Victoria stood last in productiveness but ranked first in weight per bushel with 42.8 lbs., and in earliness, with a growing period of 110 days. The latest varieties, American White and Bland White, required 122 days to ripen. All varieties weighed over 39 lbs. per bushel.

The yields of the different field crops grown on the station farm are recorded and a brief description of cooperative tests is given. In 1902 tests were carried on by 50 farmers in 16 counties; in 1903, by 204 in 21 counties; and in 1904, by 84 in different parts of the State.

Summary of press bulletins [on field crops] (*Oklahoma Sta. Rpt. 1905, pp. 32–41, 42–49*).—Previously published articles on the culture of spelt, cowpeas, corn, and cotton are reprinted. Spring-sown spelt produced at the station 9.8 bu. of grain per acre and 0.68 ton of straw, and a fall-sown crop, 6.9 bu. of grain and 0.82 ton of straw. Spelt has not given promise of furnishing pasture during fall and winter.

Field crops at Wagga Experimental Farm, G. M. McKEOWN (*Agr. Gaz. N. S. Wales, 16 (1905), No. 4, pp. 337, 338*).—Among 24 varieties of wheat Federation stood first with a yield of 22 bu. 15 lbs. per acre. Of different quantities of seed per acre, 40 lbs. gave the highest yields. Drilling proved more satisfactory than broadcasting.

The improvement of poor pastures, T. H. MIDDLETON (*Jour. Agr. Sci., 1 (1905), No. 1, pp. 122–145*).—The results for 2, 3, and 8 years of 6 experiments in manuring poor pastures are described. On a light soil potash produced but little effect, and on heavy soils phosphatic fertilizers gave highly profitable returns. In the first years the use of other fertilizers was not justified by the results, but where the work was carried on for 8 years lime was profitable after the first 3 years and potash the last 2 years. Nitrogenous fertilizers were but little effective. Phosphatic fertilizers promoted the growth of *Trifolium repens*, *T. minus*, and *Medicago lupulina*. These plants improved the soil and increased the stand of grasses. Lime favored the increase of grasses in the herbage. The first few years the available potash of the clay soil was apparently sufficient for the leguminous plants, but later the use of potash fertilizers on ordinary poor pastures became necessary. Basic slag, owing to its content of

phosphoric acid and lime, is considered useful in beginning the improvement of poor clay pastures. Specific directions for the treatment of poor pasture lands and the considerations upon which they are based are given.

Fertilizer experiments with Jerusalem artichokes, H. BLIN (*Jour. Agr. Prat., n. ser., 9 (1905), No. 17, pp. 548, 549*).—The culture of Jerusalem artichokes is discussed and the results of fertilizer experiments are reported.

An application of 15,000 kg. of barnyard manure, 300 kg. of superphosphate, and 200 kg. of muriate of potash per hectare, spread over the entire surface of the field, gave a yield of 38,323 kg. as compared with 30,556 kg. where manure alone was used, and 31,879 kg. where manure and superphosphate were applied together. When applied in the drill the application of manure and superphosphate resulted in a yield of 33,423 kg., and the complete application in a yield of 42,213 kg.

From these results it is concluded that potash is the dominating element in the culture of Jerusalem artichokes, and that applying the fertilizer in the drill gives better results than applying it broadcast, because a larger amount of potash is made immediately available to the plants.

Remarks on the "popping" of Indian corn, F. H. STORER (*Bul. Bussey Inst., 3 (1904), pt. 4, pp. 74-79*).—Experiments are reported to disprove that the popping of pop corn is due to the oil in the grain, and to determine whether popped corn contains any more soluble starch or other form of dextrin than the original grain.

Whole grains were leached with ether until the oil was removed and were then dried slowly in the air. When these grains had become thoroughly dry they popped upon being heated, although they contained no oil. The experiment also indicated that perfect dryness in the kernel is required for the best success in popping. Samples of popped corn grounds dried at 100° C. contained 19.30 per cent of matter soluble in water, and unpopped corn treated the same way yielded 21.12 per cent. Only mere traces of matters capable of reducing cupric oxid were determined in both kinds of samples, with, perhaps, the larger trace in the sample from the unpopped corn.

Samples of meal from popped corn dried at 95 to 100° C. contained 7.45 per cent of moisture, and meal from unpopped corn 12.13 per cent. It did not appear that any soluble starch is formed during the act of popping. A test in preparing soluble starch from popped and unpopped corn left the impression that rather more soluble starch was secured from the unpopped than from the popped sample.

Studies on the property of popping by several investigators are reviewed, and other experiments in this line by the author are described. He found that the removal of the outer skins of rice pop-corn kernels prevented popping, and this was the case whether the kernels had first been soaked in ether for 3 or 4 days and dried, or not. Of whole kernels cut in two crosswise of their length only the outer halves, or those farthest from the cob, popped when heated; and the same result was obtained after soaking in ether for 5 days and drying for 1 or 2 hours at 100° C. But when the kernels were cut in two lengthwise both parts popped readily in some trials. When the kernels were divided into quarters the parts lying near the cob did not pop, while in some of the outer portions the property was not destroyed.

"It is plain from the foregoing trials that the skin of the grain exerts a very decided influence on the act of popping. It would appear, indeed, that both the structure of the individual starch grains in the kernel and the toughness of the restraining skin which envelopes them all, act to control or modify the manner in which the moisture in the starch grains when suddenly heated is converted into steam of such high tension that the explosive act of popping results, whereby both the skin of the seed itself and the envelopes of most of the starch grains in the seed are ruptured."

Cotton growing on sandy upland soils, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 7, pp. 11, figs. 2*).—Former work in this line has been previously noted (E. S.

R., 17, p. 16). These experiments were made on a light sandy soil, which produced cowpeas in 1903. The cowpea stubble was plowed under, the land treated with 100 lbs. each of acid phosphate and muriate of potash mixed with 10 tons of barnyard manure and swamp muck per acre, and wheat, oats, rye, vetch, and other crops grown for grazing. These crops were pastured and later turned under. Before the cotton was planted the land was again fertilized, as has just been described. The following yields per acre were secured:

Variety and soil test with cotton.

Variety.	Seed cotton.	Lint.	Seed.	Lint at 10 cts. per lb.	Seed at 70 cts. per 100 lbs.
	Pounds.	*Pounds.*	*Pounds.*		
King	1,290	450	840	$45	$5.88
Russell Big Boll	1,340	470	870	47	6.09
Willet Red Leaf	1,290	400	890	40	6.23
Berry Big Boll	1,600	520	1,080	52	7.56
Peterkin	750	280	470	28	3.29
Crossland	1,250	480	770	48	5.39
Culpepper	1,100	390	710	39	4.97
Excelsior Prolific	1,240	420	820	42	5.74
Mixed seed	970	350	620	35	4.34

Brief notes are given on each variety and on the slight disease attack observed in the experiment. The value of clean culture was brought out in a trial in which different amounts of cultivation were given.

The commercial cotton crop of 1903–4, J. L. WATKINS (*U. S. Dept. Agr., Bur. Statis. Bul. 34, pp. 101*).—Statistics for the commercial cotton crops for 5 years, 1899–1900 to 1903–4, are summarized.

The distribution of the crop from the different States and Territories for every year of the period is shown and the number of bales shipped in the different States from the various railway stations is recorded. The distribution of the Sea Island cotton of the crop of 1903–4 is also given, together with miscellaneous statistics for a series of years bearing on the acreage, yields, prices, and values of the crops; exports and imports; the cotton-spinning industry; and the cost of picking. The world's consumption and production of cotton is shown in tables and briefly discussed, and the imports and exports are given for different foreign countries.

The commercial crop of 1903–4 was greater than the crop of 1899–1900 by over 900,000 bales, but smaller than any other crop since that season. During the last 5 years the crop in Arkansas showed an extreme fluctuation of 336,728 bales; in Georgia, 326,619; in Mississippi, 379,264; and in Texas, 1,088,094. In Alabama and the Carolinas the output has been comparatively steady, while, with the exception of the unfavorable season of 1903–4, the crop in Indian Territory, Louisiana, and Oklahoma has steadily increased. In 4 years the increase in Indian Territory was 234,836 bales; in Louisiana, 194,680, and in Oklahoma, 111,447 bales. The average commercial movement from the cotton States and Territories for the 5-year period was approximately 10,200,000 bales, as compared with an average of 9,657,000 bales the previous 5 years.

This bulletin is the last in the series dealing with the commercial movement of cotton issued by the Bureau of Statistics of this Department, this line of work having been transferred to the Bureau of the Census.

The color of hemp seed, C. FRUWIRTH (*Fühling's Landw. Ztg., 54 (1905), No. 10, pp. 325–330*).—The results of investigations show that of light gray and light and dark-grayish brown fruits of hemp, those light gray in color were lowest in weight and germination. The color of the fruit was transmitted to the larger proportion of the fruits of the progeny, and it was observed that in the same plant the fruits were quite uniform in color and shape.

Potato culture, A. J. McClatchie (*Arizona Sta. Bul. 51, pp. 541–545*).—General directions for growing potatoes in Arizona are given.

In the Salt River Valley the most favorable time for planting is the early part of February. At Yuma planting is done a little earlier, and in the Upper Gila a little later. The tubers usually reach their full size early in June. Fall crops planted late in August and early in September produce tubers during November, but do not reach full maturity. Burpee proved to be the most desirable variety for planting at the station, and Early Rose and Triumph also gave good results.

Sugar-beet culture, A. J. McClatchie (*Arizona Sta. Bul. 51, pp. 533–536, fig. 1*).—Directions for growing sugar beets, based on experiments conducted by the station during the past 6 years and previously noted (E. S. R., 13, pp. 342, 641), are given.

In the experience of the station the seed may be planted either during the latter part of September and the early part of October, or from the latter part of January to the middle of March. Fall planting requires irrigation every 10 days until December, and usually 2 heavy applications of water in February, while winter-planted beets are irrigated from April to June, the total quantity of water varying from 1.5 to 3 acre-feet. Beets planted in the fall mature late in March and then readily produce seed stalks. The winter plantings are ready for harvesting in July. After they have reached their maximum size they begin to lose in sugar and purity and soon decay.

In experiments conducted for 4 years in the Salt River Valley the yields ranged from 5 to 18 tons of beets per acre, averaging 9.7 tons for fall planting and 11.5 tons for winter planting. The sugar content in fall and winter-planted crops averaged 13.1 and 14.8 per cent, respectively. The cost of growing beets in this locality is estimated at from $30 to $40 per acre.

The influence of environment upon the composition of the sugar beet, 1903, H. W. Wiley (*U. S. Dept. Agr., Bur. Chem. Bul. 95, pp. 39, charts 3*).—The cooperative work here reported was conducted as previously described (E. S. R., 15, p. 670).

The season's work at each station is discussed in detail, and data descriptive of the soils, including the chemical analyses of both soil and subsoil, are given. The data for the season are summarized in the following tables:

Average results with Kleinwanzlebener sugar beets, 1903.

Locality.	Yield per acre.	Average weight of beets.	Analytical data.		Meteorological data: May to October.		
			Sugar in the beet.	Coefficient of purity.	Temperature.	Precipitation.	Sunshine.
	Tons.	*Ounces.*	*Per cent.*		*° F.*	*Inches.*	*Per cent.*
Washington, D. C.	14.6	18.9	8.7	71.6	67.2	21.26	57
Lexington, Ky	6.3	11.9	9.5	72.0	68.8	11.50	62
Madison, Wis	19.6	14.9	11.6	79.0	62.0	25.58	....
Ithaca, N. Y	18.4	6.0	12.2	75.0	60.2	22.66	46
Lafayette, Ind	8.9	14.9	13.2	81.6	65.9	17.35	58
Geneva, N. Y	15.6	11.6	14.2	89.4	62.6	25.56	....
Ames, Iowa	15.6	13.2	15.5	81.8	63.6	22.43	60
Irrigation stations.							
Laramie, Wyo	....	16.0	11.8	69.4	53.1	7.71	65
Fort Collins, Colo	21.3	20.8	15.1	85.0	59.0	7.13	65
Union, Oreg	18.0	14.0	15.8	88.3	58.4	5.06	....

Yield of sugar beets and soil analyses.

Station.	Yield per acre.	Chemical analysis of soils. Potash.	Nitrogen.	Phosphoric acid.
	Tons.	*Per cent.*	*Per cent.*	*Per cent.*
Lexington, Ky	6.3	0.40	0.183	0.31
Lafayette, Ind	8.9	.38	.183	.09
Ithaca, N. Y	13.4	.44	.120	.14
Washington, D. C	14.6	.25	.133	.09
Ames, Iowa	15.6	.22	.206	.06
Geneva, N. Y	15.6	.52	.109	.085
Madison, Wis	19.6	.19	.135	.13
Irrigated soils.				
Union, Oreg	18.0	.42	.277	.06
Laramie, Wyo		.73	.910	.10
Fort Collins, Colo	21.3	.67	.144	.15

The soil data represent the averages of figures for soil and subsoil. The geodetic data, except for Laramie, Wyo., and Union, Oreg., have been previously given. The altitude of Laramie is 7,130.5 and that of Union 2,689.6 ft.

The results again indicate that the content of sugar rises as the latitude increases. An intimate relation between the percentage of sugar in the beet and the length of day is also indicated. The figures likewise show that, "as a rule the temperature varies inversely as the sugar content, being highest when sugar is lowest," and vice versa. The percentage of sugar in the beet and the altitude show a general agreement, although this is not uniform, and it is concluded that the only effect of altitude is due to a decrease in temperature. The distribution of rainfall appears to have had no direct effect upon the content of sugar, although it is stated that there might be such a distribution as to influence the quality of the beet unfavorably. The data for the year are considered less decisive and less complete than for the previous seasons.

[Cooperative tests with sugar beets and alfalfa], V. K. CHESNUT (*Montana Sta. Rpt. 1904, pp. 233-235*).—About 50 lbs. of Kleinwanzlebener beet seed produced in the State of Washington, and secured by this Department, was distributed in Montana and the beets raised were tested.

The richest lot contained 22.8 per cent of sugar. The largest estimated yield of sugar per acre, 5,825 lbs., was obtained on the station farm. Vilmorin Imperial, French Red Top, and Utah sugar beets grown in comparison with this seed were inferior in every particular with the exception that the Utah-grown seed showed a purity 1.08 per cent greater than the Kleinwanzlebener. The average of 22 beets grown in various parts of the State from the seed distributed by the station contained 16.9 per cent of sugar with 82.73 per cent purity.

Experiments in inoculating alfalfa seed with cultures obtained from this Department indicated that the treatment produced more vigorous seedlings. Reports on the individual tests have not yet been made.

Experiments in the culture of sugar cane and its manufacture into table sirup, H. W. WILEY ET AL. (*U. S. Dept. Agr., Bur. Chem. Bul. 93, pp. 78, pls. 5, figs. 6*).—This bulletin is a report on investigations conducted at Waycross and Cairo, Ga., in 1903 and 1904, in continuation of previous work (E. S. R., 15, p. 245).

In 1903 experiments were conducted at Cairo on 2 fields, both old and sandy land. Fertilizers were applied in different quantities and combinations, either in the furrow or broadcast. On some plats the entire application was made at one time, while on others 2 or 3 partial applications were made at different times. In some cases the cane was planted on top of the fertilizer, which had been applied in the furrow. The season was unfavorable and the stand was poor.

The "normal" fertilizer mixture consisted of 1,200 lbs. acid phosphate, 400 lbs. cotton-seed meal, 200 lbs. nitrate of soda, and 200 lbs. muriate of potash. The results from the use of 800, 1,200, or 2,000 lbs. of the normal formula per acre showed very slightly increased profits from the larger quantities of fertilizer, and it is concluded that for seasons like 1903, 1,200 lbs. per acre is sufficient. The use of this normal formula in 2 applications gave the largest yield of cane per acre as compared with other methods, and bore out the conclusions from the experiments of 1902. The analyses of the juices showed no appreciable differences in this connection.

The yields obtained on the 2 fields proved conclusively that sugar cane can not be grown profitably on that soil without fertilizers. The unfertilized plats averaged 8.25 per cent of sucrose against an average of 10.2 per cent on the plats fertilized with the normal formula, while the purity for the unfertilized and fertilized plats averaged 69.4 and 72.9, respectively.

On practically the same soil the yield in 1902 was 9.12 tons per acre and the sucrose content, 15.72 per cent, or about double the tonnage and sugar content of 1903. The average yield of 16 unfertilized plats was 4.23 tons per acre, and of 30 plats fertilized with 800 to 2,000 lbs. of the normal formula per acre, 12.96 tons, or a gain of 8.73 tons and a profit of $20.68 per acre from the use of the fertilizer.

The indications from the special fertilizer experiments were that 800 to 1,200 lbs. of the normal mixture furnished sufficient of the individual ingredients. As in 1902, cotton seed proved too expensive as a fertilizer for cane on this soil at the present prices of seed and other fertilizer ingredients.

The experiment field which had grown plant cane in 1902 was used this season for a test with stubble cane. The stubble was treated in the usual manner, and in April an application of 400 lbs. per acre of the normal formula fertilizer was applied around the roots and in June another application of 400 lbs. was made. This land was better in quality than that devoted to the experiment described above, and hence the general yield was greater. The rattoon crop of 1903 apparently derived but little, if any, benefit from the application of ammonia made the year before, but was largely benefited by the potash and phosphoric acid applied at that time. Cotton seed also failed to show any residual effect.

In 1904 the experiments were again conducted on 2 fields, A with 42 plats and B with 46. Field A, a good grade of pine land with a stiff clay subsoil, was seeded to oats in the winter of 1902, followed by cowpeas in the summer of 1903. In these tests the normal formula was revised, as follows: Acid phosphate 1,200 lbs., cotton-seed meal 300 lbs., nitrate of soda 100 lbs., and muriate of potash 200 lbs., on the theory that all the phosphoric acid and potash and about half of the nitrogen should be applied at the time of planting, and the other half of the nitrogen, in the form of nitrate of soda, in 1 or 2 later applications.

The results showed a great difference in the productivity of the 2 fields, which was apparently due to the fact that cowpeas had been grown upon field A. The unfertilized plats on field A gave an average yield of 15.82 tons of hay per acre, while the corresponding plats on field B gave only 4.39 tons. The percentage of sucrose from these same plats on field A and field B was 14.07 and 12.31, respectively. The reducing sugar was also less and the purity of the juices higher for field A than for field B, so that in every respect field A showed a great superiority for cane production.

The average yields of 3 plats receiving the normal formula fertilizer were 26.62 and 17.22 tons per acre for field A and field B, respectively. The average increase per acre on field A apparently due to the fertilizer was 10.8 tons, and on field B, 12.83 tons. The percentage of sugar in the cane grown on the poorer soil and the reducing sugar and the purity were about the same as on the richer land.

The results at Waycross for 1904 are given in tables without comment. The largest yields of cane per acre were obtained from the use of 2,000 lbs. of the normal formula.

The manufacturing data comprise a report on the installation and operation of a sirup factory at Waycross. A detailed description and plan of the factory, including the machinery and apparatus, is given, and the results of the season's work in milling the cane and manufacturing the sirup are reviewed and summarized. Grinding was begun November 3 and finished December 9, the campaign covering 37 days, during which time 11,344 gal. of sirup, with an average density of 15.4° Brix., was produced.

Changes and improvements in the plant at Waycross are suggested and a report on the inspection of other plants is given. The chemical data include directions for sampling and preserving juices for analysis, methods for sirup examination with directions for the preparation of standard color solutions, and tabulated analyses of sugar cane juices and sirups for 1903 and 1904.

Manurial experiments with sugar cane in the Leeward Islands, 1903-4, F. WATTS ET AL. (*Imp. Dept. Agr. West Indies, Pamphlet 36, 1905, pp. 48, dgms. 4*).—Former results in this series of experiments have been previously reported (E. S. R., 16, pp. 44, 45).

This season the 36 different tests were repeated 10 times with plant canes and 8 times with rattoon canes. As in former years, the fertilizers were applied in varying quantities and different combinations. The guano, potash, and phosphate series did not give remunerative returns. The best results were obtained from the use of either sulphate of ammonia or nitrate of soda alone. The largest gain, which amounted to $8.78 per acre, was obtained from the use of 60 lbs. of nitrogen as nitrate of soda. Nitrogen in the form of sulphate of ammonia stood second, with a financial gain of $7.11 per acre.

It was further shown that the application of nitrogen all at one time gave better results than when it was divided and applied at 2 different times. The results pointed out in general that 20 tons of barnyard manure per acre without commercial fertilizers is adequate for plant canes and that rattoon canes, in addition to good tillage, require a dressing of from 2.5 to 3.5 cwt. of nitrate of soda or 2 to 3 cwt. of sulphate of ammonia per acre.

Seedling and other canes in the Leeward Islands, 1903-4, F. WATTS ET AL. (*Imp. Dept. Agr. West Indies, Pamphlet 33, 1905, pp. 61*).—A summary is given of tests with plant and rattoon canes in Antigua and St. Kitt's and of experiments in the chemical selection of sugar canes, the raising of new seedlings, and in the treatment of plant tops and cuttings with germicides before planting. Ordinary cultivation was given in all tests with canes to make the results comparable with common practice.

In the plant-cane test in Antigua, Sealy Seedling ranked first in the production of sucrose in the juice with 9,914 lbs. per acre. Canes B. 156, B. 306, B. 208, and D. 95, mentioned in the decreasing order of sucrose production, ranked next to Sealy Seedling. These same varieties also stand among the first 7 in the average results for 3 years. Sealy Seedling and B. 306 ranked high in the rattoon test.

B. 393 and B. 208 stood first among the plant canes tested in St. Kitt's. White Transparent, Mont Blanc, and B. 306 appeared to be most drought-resistant, while the results with B. 208 indicated the need of a greater rainfall. In the rattoon test for the year D. 115, B. 306, and B. 208 led in the production of sucrose in the juice, and these same varieties retained the lead in the average results for 3 years, with B. 306 ranking first and D. 115 second.

As a result of using cuttings either high or low in sugar content, there was a gain of about 10 per cent in sucrose in the cane from the high sugar cuttings over those from the low sugar cuttings. Treatment with Bordeaux mixture tended to preserve cane cuttings while in the soil and increased the number of plants grown from cuttings by 62 per cent. Tarring the ends of the cuttings gave an increase in the number of plants grown of only 34 per cent.

Sugar-cane experiments in Cuba (*Agr. News [Barbados], 4 (1905), No. 81, p. 146*).—Among different new varieties of sugar cane under test in 1904, B. 208, D. 95, and Caledonia Queen ranked first in sugar content and purity.

Variation in the chemical composition of the swede, S. H. COLLINS (*Jour. Agr. Sci., 1 (1905), No. 1, pp. 89–107*).—This article summarizes the work of 5 years with swedes and shows the results of analyses of 14 varieties grown in different localities.

The individual root, its size, the fertilizers applied, the variety, the season, and the soil and locality are discussed as factors influencing the composition. The relative merit of varieties was found to be fairly uniform over a large area. The results show an average of 12.39 per cent of dry matter in swedes from the North of England. A list of the varieties in the order of merit, according to the percentage of total dry matter based on the average of all results to the end of 1904, is given. Fell Bronze Top and Webb Imperial are the leading varieties.

The manurial requirements of the swede crop, J. PERCIVAL (*Univ. Col. Reading, Agr. Dept., Ann. Rpt. Field Trials and Expts., 11 (1905), pp. 1–19*).—Cooperative fertilizer experiments were made with swedes.

The fertilizers were used in quantities supplying the essential elements at the following rates per acre: Nitrogen 10, 20, and 40 lbs.; phosphoric acid 40, 80, and 160 lbs.; and potash 20, 40, and 80 lbs. On nearly all farms the omission of potash reduced the yields. The application supplying 40 lbs. of nitrogen, 160 lbs. of phosphoric acid, and 80 lbs. of potash produced the largest increase in crop. While the heavier applications gave an increase in yield, the cost of this increase rose with the quantity of fertilizers applied. The use of fertilizers seemed to improve the stand and the power of the plants to resist insect attacks.

Experiments on the influence of fertilizers upon the yield of timothy hay when grown on Dunkirk clay loam in Tompkins County, New York, J. W. GILMORE and S. FRASER (*New York Cornell Sta. Bul. 232, pp. 32–46, figs. 5*).—The chemical and mechanical analyses of Dunkirk clay loam soil upon which these experiments were conducted are reported. In the fall of 1903 the plats received commercial fertilizers, stable manure, and lime, and the following spring they were sown to oats and timothy at the rate of 9 pk. and 15 lbs. per acre, respectively. Commercial fertilizers were again applied in the spring of 1905, but no manure and lime were used.

In 1904, 8 unfertilized plats produced 53.8 bu. of oats per acre, while 14 fertilized plats produced 59.6 bu. The use of a complete fertilizer high in nitrogen and phosphoric acid, and of 20 tons of stable manure per acre, was apparently most effective in increasing the yield of oats; but in these as in all other cases the increase did not pay for the treatment.

The yield of timothy hay in 1905 on 8 untreated plats was 2,160 lbs. per acre; on 3 plats receiving only mineral fertilizers, 2,890 lbs.; on 8 plats treated with nitrate of soda, 4,676 lbs.; and on 2 plats receiving stable manure, 4,805 lbs. Two applications of 320 lbs. each of nitrate of soda and acid phosphate and 80 lbs. of muriate of potash per acre gave an apparent increase in yield of 10.3 bu. of oats and 4,137 lbs. of timothy hay. A single application of 10 tons of stable manure apparently increased the yield of oats by 5.3 bu. and of hay by 2,595 lbs., and 20 tons of manure, by 11.2 bu. of oats and 4,025 lbs. of hay per acre. From seed in the manure red and alsike clover were introduced into the meadow. Estimating the cost of the manure at 50 cts. per ton, the net gain from the use of 10 tons was $10.55, and from 20 tons $15.14. The use of nitrogen in the fertilizers gave a marked increase in hay but only a small increase in the yield of oats.

The results of the experiment are believed to indicate that if the proportion of nitrogen to phosphoric acid had been greater the returns would have been more profitable. Muriate of potash applied either alone or with nitrate of soda gave a net gain. Lime had no influence on the growth of timothy, but in other experiments

on this type of soil has shown a marked effect upon the growth of alfalfa. The results as a whole are regarded as emphasizing the importance of the systems of farm management which will bring to this type of soils the largest supply of readily available nitrogen, and as pointing out in this connection the value of growing leguminous crops and of properly preserving stable manure.

The influence of the season on the composition of wheat, F. WOHLTMANN (*Deut. Landw. Presse, 32* (*1905*), *No. 36*, *pp. 309-311*).—The fluctuation in dry matter, ash, and protein content of American, Turkestan, and German varieties of spring and winter wheat for the seasons of 1896 to 1904, inclusive, is reported and the influence of the weather conditions in this connection is discussed.

The American varieties comprised 23 of spring wheat and 45 of winter wheat, while only 5 German varieties and apparently only 1 variety of Turkestan wheat, all spring-wheat varieties, entered into the experiment. In dry matter the fluctuations were not very great between the wheats from different sources, but in ash and protein content the differences were quite marked. The protein content in American spring-wheat varieties showed a fluctuation of 32 per cent, in the Turkestan wheat 25 per cent, and in the German varieties 38 per cent.

A wheat with numerous aliases, C. E. THORNE (*Ohio Sta. Bul. 152*, *pp. 210, 211*).—Five plats of wheat from seed procured from as many different localities and known under different names were apparently all of the same variety, and although large claims have been made for the wheat under the name of Prosperity, the yields were not equal to those of Velvet Chaff, a variety of medium productiveness, as shown by 10-year tests at the station.

Mendel's laws of inheritance and wheat breeding, R. H. BIFFEN (*Jour. Agr. Sci., 1* (*1905*), *No. 1*, *pp. 4-48*, *pls. 2*, *dgm. 1*).—This article discusses Mendel's law as applied to wheat breeding, reviews the work of several investigators, describes the differentiating characters of wheat and the method of artificial cross pollination, and reports the results of experiments begun in 1900 with a view to improving English varieties.

Brief descriptions are given of 18 varieties used in crossing and of the resulting crosses, together with a detailed account of the various characters and their behavior in the cross and in the first generation. In summing up the author presents the following grouping of characters showing pure dominance and resembling those described in peas by Mendel:

Dominant.	*Recessive.*
Beardless heads.	Bearded heads.
Velvety glumes.	Smooth glumes.
Keeled glumes.	Round glumes.
Loose heads.	Compact heads.
Red chaff.	White chaff.
Red grain.	White grain.
Thick and hollow stem.	Thin and solid stem.
Rough leaf surface.	Smooth leaf surface.
Bristle stem.	Smooth stem.
Large sclerenchyma girders and angular stem outline.	Small sclerenchyma girders and almost circular stem outline.
Hard, translucent endosperm.	Soft, opaque endosperm.
Susceptibility to yellow rust.	Immunity to yellow rust.

Irregular dominance was observed in the crosses in velvety and glabrous glumes and gray and red or white glumes. In other cases the pairs of characters showing no dominance and in which the cross was intermediate between the parents were

loose and compact heads, large and small glumes, long and short grains, and early and late maturity.

Some practical suggestions concerning seed germination, J. J. THORNBER (*Arizona Sta. Bul. 51, pp. 536-541*). Experiments were made to study the effect of mechanical and hot water treatment on the germination of the highly moisture-resistant seeds of a number of semiarid plants. The author found that when the hard resistant seed coats were rendered permeable to water by scratching, cutting, or grinding, the germination of the seeds under normal conditions took place immediately. In the tests with hot water treatment upon several kinds of seeds, such as locust, acacia, and mesquite, the best results were obtained by placing the seeds in hot water for 2 minutes, then soaking them in lukewarm water for 12 to 24 hours, removing the swollen ones, and again subjecting the rest to the treatment until they swelled. Four lots of 50 catclaw seeds each, immersed for different lengths of time in water at 85 to 88° C. gave the following results: One minute immersion, 8 seeds swollen and 33 germinated; 2 minutes, 27 swollen and 36 germinated; 3 minutes, 40 swollen and 41 germinated; and 4 minutes, 40 swollen and 33 germinated.

A list is given of seeds which were successfully germinated by stratifying them during the winter and planting early in the spring in well-prepared soil.

The vitality of seeds, W. J. BEAL (*Proc. Soc. Prom. Agr. Sci., 26 (1905), pp. 89-93*).—Previously noted (E. S. R., 16, p. 622).

HORTICULTURE.

Report of the [Oregon horticultural] commissioners, E. L. SMITH ET AL. (*Bien. Rpt. Bd. Hort. Oregon, 8 (1905), pp. 7-48, pls. 10, figs. 7*).—An account is given by the commissioner at large, the commissioners of each of the 5 fruit districts into which Oregon is divided, and the secretary of the board of horticulture, on the progress of fruit culture in the different districts of Oregon with statistics in certain instances as to the amount of fruit grown in different districts and individual orchards, and notes on various other factors affecting the fruit industry of that State, such as methods of culture, canning factories and evaporators, orchard and nursery inspection, etc.

Horticulture in Oregon, H. E. DOSCH (*Bien. Rpt. Bd. Hort. Oregon, 8 (1905), pp. 219-235, pls. 2*).—A general discussion of this subject, with the estimated cost of establishing and maintaining peach, apple, and prune orchards and vineyards in different parts of Oregon, and a discussion of markets.

Horticultural department, R. W. FISHER (*Montana Sta. Rpt. 1904, pp. 239-248*).—A brief outline of the work of the year with ornamental trees and shrubs and with vegetables. Onions were seeded in the greenhouse and transplanted in comparison with field-sown seed. The transplanted onions gave the better yields. Early planting in the field, however, proved much better than late planting.

Vegetable gardening, S. B. GREEN (*St. Paul: Webb Pub. Co., 1905, 7. ed., pp. 252, figs. 123*).—This well-known book on vegetable gardening for northern latitudes has been revised to some extent and enlarged. A number of test questions have been included, which better adapts it for use in the class room, and a different arrangement has been made in the grouping of the vegetables treated.

Notes on the forcing of tomatoes, cucumbers, and melons, C. E. HUNN and J. CRAIG (*New York Cornell Sta. Bul. 231, pp. 15-29, figs. 9*).—In forcing experiments with tomatoes the best 4 varieties for general midwinter forcing were Lorillard and Combination of the American varieties and Frogmore and Holmes Supreme of the English varieties.

Many trials have been made with soap solutions, tobacco preparations, and hydrocyanic-acid gas for the control of the white fly in the greenhouse. The hydrocyanic-

acid gas has proved most satisfactory when properly used. The best conditions, as found in the authors' experiments, are absolute darkness, still air, temperature below 60° F., and a dry house. Under these conditions it has been possible to keep down the white fly by fumigating once each month with 1 oz. of cyanid of potassium, 2 oz. of sulphuric acid, and 4 oz. of water to each 1,000 cu. ft. of house space. When fumigations were made in daylight with larger amounts of cyanid there was considerable injury to the foliage of tomatoes and severe injury to the foliage of chrysanthemums, geraniums, and begonias.

The time required for forcing a crop of melons is placed at approximately 6 months, and the cost of a full crop is about $1 per melon. The English types of melons have been found to give the best results in forcing.

Notes are given on the beginning of the cucumber forcing industry in New England by Dr. J. Fisher, and on commercial methods of growing cucumbers in Massachusetts by G. M. Kendall, from which it appears that the best soil in which to force cucumbers is a sandy loan mixed with about one-third fresh horse manure. The vine is trained up to about 10 ft. and nipped off. Each lateral is also nipped off at the first joint beyond the cucumber. White Spine is the variety chiefly grown. The temperature of the house should be about 65° at night and 90° to 100° on good sunshiny days.

At the station, the authors have grown chiefly the long English type of cucumber. This type is grown in shaded houses, as the large succulent leaves burn if exposed to full sunlight. General directions are given for their culture and care in the greenhouse.

Soil treatment in greenhouse culture, H. J. Wheeler and G. E. Adams (*Rhode Island Sta. Bul. 107, pp. 157-167*).—An experiment was made to determine the initial and residual effects of stable manure and different kinds of commercial fertilizers when used for different greenhouse crops.

In the test 1,400 lbs. of subsoil was used in each of 4 sections. The soil was first treated with lime to correct acidity. Section 1 was then fertilized with horse manure at the rate of 75 tons per acre. Sections 2, 3, and 4 were given identical amounts of potash, phosphoric acid, magnesia, and nitrogen in different commercial forms. On section 2 such chemicals were used as would not be likely to leave any injurious residues in the soil.

On section 3 potash was applied in the form of muriate instead of nitrate, as in section 2, and sulphate of ammonia was used as a source of part of the nitrogen applied. Both these sections received in addition mixed timothy and redtop hay cut in lengths of half an inch to an inch and thoroughly incorporated in the soil. Section 4 was treated exactly like section 2 except that no chaffed hay was used.

The first crop grown was radishes. The manured section led all the others in yield and size, 1,400.6 gm., sections 2, 3, and 4 following in regular order, the latter yielding only 952.2 gm. Section 2 yielded nearly as well as the manured section, 1,376.7 gm.

A second crop of radishes was then grown after additional fertilizers had been added. The smallest yield with this second crop was on section 1, where stable manure was used, and the largest on section 2, where care had been taken to avoid chemicals which might leave toxic residues in the soil.

This crop was then followed by tomatoes on half of each section and cucumbers on the other half. The largest total yield of tomatoes, 11,852 gm., was obtained on section 3, showing that the residuals of the chemicals used had no toxic effect for this crop. The yield of cucumbers on the manured section was nil, due to lack of nitrogen, caused by denitrification processes which were especially favored by the use of such large amounts of manure under the favorable conditions afforded by the greenhouse.

Section 2 gave the largest total yield, 1,724 gm.; section 3 yielded 1,272 gm., indicating that the sulphate and chlorid residues of the fertilizers used on this plat were injurious to cucumbers, while section 4, which had no chaffed straw, yielded the smallest crop of all, 353 gm.

Report on the fruit industry of Great Britain, A. G. BOSCAWEN ET AL. (*London: Dept. Com. Fruit Cult., 1905, pp. III+39*).—This is a report of the committee appointed by the Board of Agriculture and Fisheries, to investigate the present condition of fruit culture in Great Britain and to consider methods for its promotion and encouragement.

The total acreage under orchards in 1904 was 243,008, of which 236,705 acres were in England, 2,490 acres in Scotland, and 3,813 acres in Wales. There were also 77,947 acres in small fruits, of which 70,612 acres were in England, 6,072 acres in Scotland, and 1,263 acres in Wales. The fruit industry of Great Britain while small appears to be the only form of agriculture which has exhibited any sign of progress in recent years. The various difficulties and drawbacks to the fruit industry of Great Britain were examined into at length from the standpoint of knowledge of the industry, land tenure, taxation, railway grievances, foreign competition, labor, etc.

As a result of the investigation, it is believed that there is opportunity for a considerable extension of the fruit industry. Forty recommendations are made. One of these is to the effect that a special department of the board be established which shall consist of a bureau of information and an experimental fruit farm. It is recommended that horticulture be taught in elementary schools and country districts, and that the study of practical horticulture in training colleges be encouraged.

Studies on apples, W. D. BIGELOW, H. C. GORE, and B. J. HOWARD (*U. S. Dept. Agr., Bur. Chem. Bul. 94, pp. 100, pls. 5, figs. 30*).—Details are given of an extended investigation on the chemical changes which take place in the storage, respiration, and growth of apples and on the insoluble carbohydrates or marc of apples. The results of microscopic and macroscopic examinations of apple starch are also given. Preliminary to the experimental details an extensive review is given of the work on the ripening and respiration of fruits as observed by many other investigators.

In the present work the varieties Ben Davis, Bough, Early Strawberry, Huntsman, Northern Spy, Rhode Island, Winesap, Winter Paradise, and Yellow Transparent were used. These are described and the nature of the soil on which they were grown noted. Analyses are given of these varieties when picked at different dates and when held in common storage and in cold storage. From the results secured in this work it appears "that the changes in composition (the content of starch, sugar, and acids) in cold storage do not greatly differ from those which occur in common storage, the chief difference being in the rapidity with which the changes take place."

The results of respiration experiments with apples in common and cold storage indicate that the fruit kept in common storage at the higher temperature ripened much more rapidly than that kept in cold storage. In comparing the amount of carbon dioxid eliminated from the fruit in these experiments with the malic-acid curve, it did not seem possible that the carbon dioxid could be accounted for by the disappearance of malic acid, as some other authors have considered to be the case.

"On the other hand, the curve representing the content of total carbohydrates, expressed as invert sugar, is approximately the reverse of the curve representing the evolution of carbon dioxid. The probability that the carbon dioxid results from the decomposition of carbohydrate bodies is strengthened by the fact that after protracted storage the apple has apparently lost vitality, and changes in composition proceed much more slowly than in the early days of storage."

In considering the growth of apples, the work was not begun until after the "June drop" was over. It was found in this work "that the less mature the fruit is when gathered the more rapid are the changes tending to maturity after picking. It would

seem, therefore, that from a commercial standpoint apples which are fairly mature may be expected to retain a more constant composition than those picked in an immature state."

The differences in the chemical changes which occur in the growth of winter and summer apples are traced in considerable detail. It was found that green apples ordinarily mature much more rapidly when stored than when left on the tree and that the apples picked the earliest mature more rapidly than those picked at a later date. The methods of analysis followed by the authors in this work are given in detail, together with methods followed by other investigators along the same line.

In the work on the insoluble carbohydrates or marc in apples a review is given of the characteristics of pectin bodies as observed by many other investigators with different fruits and vegetables. A table is given showing the results of analyses by the authors of apple marc. In the microscopic and macroscopic examinations of apple starch it was found that the size of the starch grain varies widely according to the condition of maturity of the fruit. A table is given showing the results of measurements of starch grains from several varieties. Generally speaking, the starch grains from within the core line are smaller than those from the torus flesh. In the ripening of apples the intercellular air in the flesh of the fruit seems to increase constantly as the fruit approaches maturity. The specific gravity appears to diminish from 2 to 5 per cent.

The "mealiness" of apples was found to be due largely to the softening of the middle lamella of the cell walls which occurs in the last stages of ripening. In mealy apples the cells under pressure are, for the most part, separated from each other instead of being torn apart individually as in less mature fruit. Mealy apples may contain as much juice as apples not so ripe, but do not appear to because of the separation of the cells instead of their splitting or tearing apart in crushing. Photographs are given showing the starch content of apples and its position in the apple at different stages of maturity.

Pear culture, A. J. McClatchie (*Arizona Sta. Bul. 51, pp. 554–557*).—The statement is made that this fruit is easily grown in Arizona, the tree being little affected by the heat and the blossoms seldom injured by frost. "It is free from diseases or insect pests, bears more regularly than any other fruit, ripens good fruit through a longer season, and is longer lived than any other." Popular directions are given for its culture in Arizona with suggestions as to varieties for planting.

Japan and hybrid plums, H. N. Starnes (*Georgia Sta. Bul. 68, pp. 38, pls. 8, figs. 34*).—In a previous bulletin (E. S. R., 16, p. 67) the value of native and European plums in Georgia was considered. In the present work the success of Japan and hybrid plums in the State is noted, the varieties grown being described at considerable length. Tables are given showing the dates of blooming and fruiting of each variety, including one table in which the fruiting periods of native plums are combined with Japan and hybrid plums.

Generally speaking, the Japan and hybrid plums are much more useful in Georgia than native or European varieties. "They are larger, handsomer, better shippers, and usually firmer and of finer quality than any of the natives, except certain members of the Americana and Miner groups. They are also, as a rule, less subject to curculio." From the data given in the tables of blooming and fruiting, it appears that more than half of the varieties that are earliest to bloom are latest to ripen fruit.

Among the maladies of plums special attention is given to "wilt," crown gall, and the borer. The "wilt" is believed to be bacterial in character, but attempts at inoculation have thus far failed. The varieties so far entirely exempt from "wilt" are Apple, Bartlett, America, Marietta, Excelsior, and Babcock, all except Babcock being hybrids.

Relative to the borer, the author states that contrary to previous belief 90 per cent of the larvæ emerge from their channels in the base of the tree trunk in the vicinity

of the station about the first of August instead of much earlier, as it was assumed they would do. The remedy suggested for this insect is to wrap the base of each tree about the last week in July for 18 in. from the ground in brown paper or newspaper, tying it with twine and wire. After this the base of each trunk should be mounded up 10 in. high around the paper covering. About the last week in October the paper is removed and the worms dug out.

Contribution to the study of varieties of olives called "table or pickling olives" (*Bul. Dir. Agr. et Com.* [*Tunis*], *9* (*1905*), *No. 36, pp. 393–398*).—Analyses with reference to oil content and physical characters are given for 5 varieties of olives grown in Tunis, with a discussion of the same.

Pickling olives for home use, W. W. Skinner (*Arizona Sta. Bul. 51, pp. 550–554*).—Popular directions are given for pickling olives on a small scale.

Cultivation of oranges in Dominica, H. H. Bell (*Imp. Dept. Agr. West Indies, Pamphlet 37, 1905, pp. 52*).—A popular pamphlet on the culture of oranges in Dominica, including some statistics of the Jamaica orange industry.

A new banana from Madagascar, P. Claverie (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 24, pp. 1610–1612*).—A botanical account is given of a new variety of banana which the author names *Musa perrieri*.

On the effects of ringing, Leclerc du Sablon (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 23, pp. 1553–1555*).—The author ringed pears, quinces, and Japanese euonymus, aged 3 to 4 years, on February 9 before vegetation started, and a second lot May 8 after the first shoots had formed. At intervals of 2 months thereafter the trees belonging to each of the 3 groups were harvested and analyzed.

The results obtained with pears are given in detail as regards roots, stem, and leaves. The roots of the trees ringed in February contained more reserve material than the control trees not ringed, while the stems contained less. After April, however, as a result of assimilation by the leaves, the roots of the ringed trees were much poorer in reserve material than those of the control trees.

On the whole the experiment is believed to show that toward the end of winter and the commencement of spring the reserve material goes from the roots to the stem. From May to October the current of elaborated material is from the stem toward the roots. Like results were obtained with quinces and Japanese euonymus.

Winter storage of nursery stock, M. Cooper (*Amer. Florist, 25* (*1905*), *No. 902, pp. 329–333, figs. 3*).—The author states that the winter storage of nursery stock has become a permanently established feature of the nursery business.

From his own investigations and the results of experimental work by others he concludes that the best results in such houses will be obtained if they are maintained at a uniform temperature of 28 to 30° F. At this temperature very little ventilation will be necessary; the loss of vitality through drying out or shriveling is slight; and there is a minimum tendency to mold and mildew. Packing material around the roots and spraying with water would be unnecessary.

Diagrams are given showing methods of construction of a suitable storage house for nursery stock and suggestions made regarding the establishment of the refrigerating apparatus. The experiences of a number of nurserymen with cold storage are quoted.

Forcing strawberries, C. E. Hunn and J. Craig (*New York Cornell Sta. Bul. 231, pp. 5–14, figs. 7*).—This is the second report of the station on this subject (E. S. R., 9, p. 353). The various factors studied were varieties best adapted to forcing, time required to mature the crop, the effects of varying temperatures, and economic methods of handling the plants.

Nearly 100 American varieties, 8 French varieties, and 5 English forcing varieties have been forced in the greenhouse. Neither the English nor French varieties have given satisfactory results. Experiments with American varieties indicate that the midseason varieties are preferable to either extra early or late varieties. The 3

varieties found most desirable for forcing are Glen Mary, Marshall, and President, each of which possesses distinct merits of its own.

Plants for forcing are secured by rooting the runners in 2-in. pots filled with rich soil. From these 2-in. pots it has been found that the plants can be shifted directly into the 6-in. forcing pots instead of more frequent shifting as has been previously considered desirable. Plants that have had a long period of rest and have been frozen hard have been found to give better results when forced than others which have had only a short rest.

As regards temperature for strawberries, "starting with dormant plants taken from the cold frame, heat should be raised gradually from 30 to 45° by the end of the first week, increasing the heat until the plants are in bloom, when they should be growing in a temperature of from 60 to 65°. From the time pollination begins, the house should range from 65 to 70°; and while the fruit is swelling, the heat should never be allowed to fall below 70°."

In one experiment when the plants were coming into bloom part of them were removed to a carnation house where the temperature was kept at near 52° F. When the fruit on the plants kept in the warm house was ripe, the fruits on the plants kept in the cool house were small and hard, uneven in form and poor in coloring. When these immature fruits were removed from the plants and the plants carried into the warm house they matured a fair crop of berries in about 4 weeks' time, showing that if occasion arises the fruiting period of strawberries can be delayed by keeping them at a low temperature. A list is given of the varieties tested for forcing at the station.

Small fruit preserving in bulk (*Agr. Economist, 38 (1905), No. 424, p. 107, fig. 1*).—An illustrated account is given of the method of preserving small fruit in bulk as observed by the cooperative growers in New Zealand.

The fruit is placed in casks holding when full about 3.5 tons and stirred by beaters simultaneously with the introduction of sulphur-dioxid gas, which is forced into the vat from below through pipes. The process is used chiefly with raspberries and black currants. The fruit thus treated presents a somewhat bleached appearance, but when it is boiled the sulphur evolves "and the fruit reverts to a bright natural color."

In jam making this fruit is first boiled for about 20 minutes before the sugar is added in order to drive off the sulphur.

Experiments in electrifying grape cuttings and rooted plants with a current of high tension, F. HONCAMP (*Centbl. Agr. Chem., 34 (1905), No. 6, pp. 394–396*).—Experiments were made along these lines to see whether an electric current of high tension would injure grapevines if this means were taken to combat Phylloxera. As a result of the experiments it is believed that in combating Phylloxera by electricity no fear need be entertained as to harmful results to the plants from this source.

The wild coffees of French Guinea, A. CHEVALIER (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 22, pp. 1472–1475*).—An account of the wild coffees of French Guinea in Africa, including *Coffea stenophylla*, *C. affinis*, and a new species *C. maclaudi*.

A botanical description is given of the latter species. It appears to be a shrub about 12 to 15 ft. high found growing at an altitude of about 2,100 ft. A kilogram of dried coffee contained 10,600 grains. The coffee made from this species had a somewhat bitter taste like all wild coffees but was agreeable, resembling much the coffee from *C. excelsa*.

Nut growing, J. B. PILKINGTON (*Bien. Rpt. Bd. Hort. Oregon, 8 (1905), pp. 328–330, pls. 2*).—The author believes nut culture will become a permanent industry in Oregon.

In this paper especial attention is given to the culture of English walnuts and filberts. One orchard is cited that was grown from second generation seedlings, which is giving very satisfactory results. The seedling trees are larger at the same age and grow more rapidly than grafted trees. It is maintained, however, that grafted trees are more desirable than seedling trees provided they can be obtained at reasonable cost.

Special care must be taken in planting these nuts. Only the late-blooming French varieties should be planted. Those which bloom early are likely to be nipped by frost and not produce fruit. A successful filbert orchard is noted in which the varieties Barcelona, Du Chilly, Red and White Avelenes are grown. These trees are grown as standards. The preceding season they were 9 years old and bore 25 lbs. of nuts each.

A few modern peonies, G. C. WATSON (*Amer. Florist, 24 (1905), No. 890, pp. 989, 990, pl. 1*).—Illustrations and descriptions are given of 26 named varieties of peonies.

Hybridizing the peony, G. HOLLIS (*Horticulture, 2 (1905), No. 3, pp. 59, 60, figs. 5*).—The author has produced a large number of varieties of peony by hybridization and selection. A number of these are briefly described. Suggestions on culture are included.

A répertoire of colors to aid in the determination of the colors of flowers, leaves, and fruits (*Répertoire de couleurs pour aider à la détermination des couleurs des fleurs, des feuillages, et des fruits. Rennes: Imprimerie Oberthür; Paris: Librairie Horticole, 1905, pp. 82, pls. 365*).—This work, illustrating 365 tones of colors, was published by the French Chrysanthemum Society and R. Oberthür, with the collaboration of H. Dauthenay et al. The names of the color tones are given in English, German, French, and Italian, and are accompanied with a complete index in each language.

What is horticulture? L. H. BAILEY (*Proc. Soc. Prom. Agr. Sci., 26 (1905), pp. 31-40*).—Presidential address before the Society for Horticultural Science at its annual meeting in December, 1905, previously noted (E. S. R., 16, p. 423).

FORESTRY.

The forest reserves of California, A. F. POTTER (*Forestry and Irrig., 11 (1905), No. 8, pp. 384-387*).—Up to June, 1905, 14 forest reserves, approximating 14,250,000 acres, had been established within the State. Six of these reserves, established since January 1, 1905, are briefly described. Extensive experiments are under way in tree planting on brush-covered areas to determine the adaptability of different species of conifers in reforesting treeless areas.

Reforesting in California, T. P. LUKENS (*Forestry and Irrig., 11 (1905), No. 8, pp. 347-349*).—An account of the efforts that are being made to reforest the mountain watersheds in southern California with descriptions of methods of seed sowing and methods of planting the different shrubs and trees used for the purpose.

Forest fires and the forest in the California Sierras, W. F. HUBBARD (*Forestry and Irrig., 11 (1905), No. 8, pp. 354-364, figs. 9*).—The author discusses the effects of fire in the denser timbered regions of the Sierras, in the more open forest, and in the chaparral field, and methods of fire regulation and control for the protection of virgin timber, old logged land, and land as it is logged.

Forests and forestry in Connecticut, A. F. HAWES (*Forestry and Irrig., 11 (1905), No. 7, pp. 301-305, figs. 2*).—The author states that the forest area of Connecticut is steadily increasing, but the character of much of the wood growth is poor.

Chestnut is the most important tree of the State, and white pine the next. About a quarter of the total area of the State is nearly worthless land, which is gradually

coming up to gray birch, pitch pine, and juniper. The advantages of thinning are pointed out and records given of the productiveness of different small areas.

Under the provisions of a late law about 1,000 acres of sprout land has been purchased by the forester of the State at a cost of $1.63 per acre, upon which experiments in planting, thinning, etc., will be carried out.

Connecticut's new forest law (*Forestry and Irrig.*, *11* (*1905*), *No. 7*, *pp. 306–308*).—The text of the recent law passed in Connecticut with reference to fire wardens and the protection of forests from fire is given.

Notes on the flora, especially the forest flora, of the Bitter Root Mountains, L. H. Pammel (*Proc. Iowa Acad. Sci.*, *12* (*1904*), *pp. 87–100*, *pls. 6*).—An account of the survey of that part of the Bitter Root Mountains west and south of Hamilton, containing considerable data relative to the proportions of the different species of coniferous trees and their rates of annual growth at different altitudes and in different years. Mention is also made of introduced and weedy plants in that section of the country.

Forest management in Bavaria and Saxony, C. S. Orwin (*Jour. Southeast. Agr. Col. Wye*, *1905*, *No. 14*, *pp. 249–261*).—The author reports upon a tour of inspection of the oak and beech woods of the Spessart district of Bavaria, the pine woods of Bamberg in Bavaria, and the spruce woods of Saxony, describing the objects of management in each case, methods of regeneration, etc.

The leaf-shedding disease (*Hysterium pinastri*) is stated as one of the worst scourges of the pine. It has been controlled by spraying with Bordeaux mixture. The spraying is done once a year in July or August for 4 or 5 years.

Reports on forest administration in Burma for the year 1903–4, J. Copeland et al. (*Rpts. Forest Admin. Burma*, *1903–4*, *pp. 189*).—An account of the extent and character of the State forests and their management as regards working plans, protection, sylviculture, and exploitation, with a financial statement as to receipts and expenditures.

During the year tapping experiments were performed on Chavanessia creepers. The quantity of rubber yielded by this plant did not pay for the cost of extraction. When the plant was cut down to the root and then chopped into small pieces no better results were obtained.

The experimental garden in the Tenasserim Circle contains 79.5 acres of Hevea rubber trees planted in 1878–9.

A series of systematic tapping experiments was carried out with these trees with the following results. Trees 2 to 4 ft. in girth yielded an average of 4.4 oz. of rubber per tree; 4 to 5 ft., 7 oz.; 5 ft. and over, 16 oz. The latex of the older trees was much richer in rubber than the younger trees. Thus, 100 cc. of latex from trees 2 to 3 ft. in girth yielded 1.38 oz. of rubber. From trees 3 to 4 ft. in girth the yield was 1.73 oz.; from trees 4 to 5 ft. in girth, 2.26 oz.; and from trees 5 ft. and over, 2.94 oz.

The experiments indicated that a man could tap from 10 to 20 trees a day, according to their girth, and could collect on an average 550 cc. of latex, representing 6.6 oz. of dry rubber.

Administration report of the forest department in the Bombay Presidency, including Sind, for the year 1903–4, G. P. Millett et al. (*Admin. Rpt. Forest Dept. Bombay*, *1903–4*, *pp. 202*).—An account of the extension and constitution of State forests in the different circles of the Presidency, and of their management during the year, with a statement of the financial results. In the report of the Sind Forest Circle a list of the vernacular terms used in the report with reference to different species of trees, etc., is given.

Rubber cultivation in the West Indies (*West Indian Bul.*, *6* (*1905*), *No. 2*, *pp. 139–149*).—This consists of a paper on Castilloa Rubber in Tobago, by M. Short, with a discussion of the same by members of the agricultural conference.

At Tobago the author states that Castilloa requires no shade. The experiments at that place indicate that about 12 ft. apart is the best distance for Castilloa trees. Tapping experiments indicate that from ¾ to 1 lb. of rubber per annum may be safely reckoned on as the average yield of trees 13 to 14 years old. Trees 9 years old yield about half as much. In discussing this paper J. H. Hart stated that experiments carried out in Trinidad proved that Castilloa required shade in that place.

The article is concluded with an appendix in which Castilloa as a shade tree for cacao is discussed.

The India rubber of commerce, M. CHAMNEY (*Transvaal Agr. Jour., 3 (1904), No. 9, pp. 99–103*).—An account is given of the India rubber of commerce, or caoutchouc, in which historical statements are given regarding its discovery and utilization and figures presented showing the sources of supply and the consumption. The principal supplies come from Brazil, Central America and Mexico, Africa, Java, Borneo, Madagascar, and India. The world's supply in 1889, the latest figures obtainable, was about 1,253,000 cwt., while the consumption was 1,250,000, leaving a margin of only about 3,000 cwt.

The principal species producing the caoutchouc are listed, of which the genera are Willughbeia, Landolphia, Castilloa, Ficus, Hevea, and Manihot, and in addition since this list was prepared large supplies of India rubber have been obtained from two or more species of Kickxia, large apocynaceous trees found in central and western Africa.

New trees introduced by the Government, W. H. EVANS (*Chautauquan, 41 (1905), No. 4, pp. 345–347*).—An account of the various forest, fruit, and ornamental trees introduced by the United States Department of Agriculture from its beginning.

An adaptation of methods in forest work, W. F. HUBBARD (*Forestry Quart., 3 (1905), No. 2, pp. 91–98*).—In the preparation of a fire plan for a lumber company operating in the western yellow pine type of forest, it was desired to make an estimate of the present and future yields of timber on each quarter section separately.

As it was not feasible to spend time and money on a number of strip surveys, a variation of that method by running a series of cruisings which would give an actual tally of the trees on the tract was adopted. Comparative estimates of the future yield on a quarter section, from cruising valuation surveys and from strip valuation surveys, are given to show the closeness of the estimates by the 2 methods.

DISEASES OF PLANTS.

Diseases of the apple, cherry, peach, pear, and plum; with methods of treatment, E. M. WILCOX, (*Alabama College Sta. Bul. 132, pp. 79–142, pls. 9, figs. 2*).—This bulletin, which is largely compiled from departmental and experiment station publications, is designed to enable fruit growers to recognize some of the more common diseases of the plants mentioned in order that they may assist the station in securing data regarding the distribution and severity of the diseases in the various counties of the State.

The author has avoided technical discussions of the organisms causing the diseases as far as possible, but gives suggestions which will aid in the recognition of the diseases, and discusses methods of treatment. The material is arranged under the different headings by host plants, and chapters are devoted to the preparation of fungicides and spraying machinery. Bibliographies of the more important literature are appended to the different headings.

Some bacterial diseases of plants prevalent in Michigan, W. G. SACKETT (*Michigan Sta. Bul. 230, pp. 203–220, figs. 6*).—Popular descriptions are given of pear blight, bacteriosis of beans, black rot of cabbage, wilt of cucurbits, soft rot of the sugar beet, and the blight of the potato, tomato, and eggplant.

Fungus diseases of cotton, L. LEWTON-BRAIN (*West Indian Bul., 6* (*1905*), *No. 2, pp. 117-123*).—Notes are given on the rust, leaf spot, mildew, and anthracnose of cotton, after which a disease known locally as black boll is described.

This disease seems to be characterized by the decay of the internal parts of the boll, usually starting at the base. The seeds swell inside and the lint is destroyed. The first outward sign of disease is a curious deformation of the boll, which is followed by the other symptoms already mentioned. As the disease progresses the lint becomes slimy, changing color from yellow to dark brown or black, and finally the enlarged, partially germinated seeds practically fill the interior of the boll.

The only foreign organism present in diseased bolls is a short rod-shaped bacillus, and this appears constantly present in the diseased tissues. Until inoculation experiments have been carried on it can not, however, be definitely claimed that this bacillus is the cause of the disease.

A new disease in potatoes (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 1, pp. 37, 38*).—It is stated that *Sphærella tabifica*, a parasitic fungus especially known as attacking beets and mangels, has been recently observed occurring on potatoes. As in the case of beets and turnips, the fungus first makes its appearance on the leaves, afterwards passing into the roots, causing their destruction. On account of the fact that different crops are subject to the attacks of this fungus, care should be taken to provide rotations with nonsusceptible plants. It is believed that the application of gas lime to the soil would to a considerable extent destroy the parasite.

A disease of potatoes (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 5, pp. 294-296, fig. 1*).—A diseased condition of potatoes of the variety Evergood is reported, in which the surface of the tubers was studded with small brownish warts, and although a number of fungi were present no species seemed to be sufficiently constant to be considered the cause of the trouble. A careful study of the variety showed that the primary cause of the disease was the excessive development of lenticels in this particular variety. The experiments from which this conclusion is drawn are to be described later.

Blackleg in potatoes (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 5, pp. 296-298*).—A brief account is given of a disease of potatoes due to *Bacillus phytophthorus*, and precautionary measures to be taken for the prevention of the disease are quoted from a recent publication (E. S. R., 15, p. 374).

It has been found that potatoes, beans, carrots, turnips, cucumbers, sugar beets, mangels, etc., are susceptible to the disease, and rotations should be provided in which these plants do not occur for a number of years. Whole tubers should be planted instead of being cut into sections, as is usually the case. Care should be taken to obtain seed from districts where the disease is not known to exist, and lime or strong nitrogenous manures should not be used.

Review of the principal diseases of sugar cane, L. LEWTON-BRAIN (*West Indian Bul., 6* (*1905*), *No. 1, pp. 33-37*).—The author presents a brief summary of the principal facts regarding the rind disease caused by *Trichosphæria sacchari*, the pineapple disease due to *Thielaviopsis ethaceticus*, and the root disease attributed to *Marasmius sacchari*. Incidentally the author mentions the fact that bananas are subject to attacks of *M. semiustus*, a species related to that causing the root disease of sugar cane.

Club root in turnips (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 3, pp. 161, 162*).—Based upon experiments carried on for a number of years it is suggested that 2½ tons of common lime slaked to a fine powder and applied to an acre of infested soil will usually result in securing a crop reasonably free from this disease. It is noted from the results obtained that the effect of the lime may be more apparent on the second than on the first crop which follows its application.

The cucumber leaf blotch, A. D. HALL (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 1, pp. 19-21*).—A brief description is given of the cucumber leaf spot, caused by

Cercospora melonis, and the results of various methods of treatment for its prevention are stated.

The treatment of the soil by watering every fourth day with a solution of copper sulphate was tried, and while at first it seemed successful, later the plants were badly attacked by the fungus, and those which had been treated seemed particularly susceptible to the red spider. A second series of experiments was inaugurated, in which the plants were treated with a copper sulphate solution and with ammonium copper carbonate, but from the results obtained it seems that the use of copper fungicides does not offer any very satisfactory method of combating this disease.

The most hopeful method of treatment the author believes is the utilization of disease-resistant varieties. Where forcing houses have become badly infested with the fungus some other crop should be grown for a number of years.

A mushroom disease (*Jour. Bd. Agr. [London], 12 (1905), No. 1, pp. 47–49, fig. 1*).—An account is given of a disease of cultivated mushrooms which is due to the parasitic fungus *Hypomyces perniciosus*.

This fungus attacks parasitically the mycelium of the mushroom, causing it to become distorted and resulting in curious malformations of the spore-bearing form of the mushroom. On account of the rapid growth of the parasite all beds should be removed before spores are produced, otherwise the houses may become thoroughly infested.

If this should occur the houses in which mushrooms are grown should be completely emptied and thoroughly sprayed at intervals of 10 days with a strong solution of copper sulphate, 3 or 4 applications being given. At the same time the house should be kept warm and moist to favor the germination of the spores of the parasite, which are destroyed by the treatment suggested.

Some of the results of three years' experiments with crown gall, G. G. HEDGCOCK (*Science, n. ser., 22 (1905), No. 552, pp. 120–122*).—A summary is given of the author's experiments on crown gall, which is found on the almond, apple, apricot, ash, blackberry, chestnut, cherry, grape, hop, oak, peach, pear, plum, prune, poplar, quince, raspberry, rose, walnut, and willow.

A number of forms of the disease are recognized, some of which are little known. Those occurring on the apple, pear, and quince are said to be quite similar and have not yet been proven to be contagious. Those occurring on the almond, apricot, blackberry, cherry, peach, plum, prune, and possibly the chestnut and walnut are similar in nature and origin and are often very contagious. Those on the grape and rose appear to be slightly contagious, but can not be classed with either of the preceding groups, as far as present information goes. The crown gall on the hop is caused by a slime mold resembling *Plasmodiophora brassicæ*, the cause of club root in cruciferous plants.

Experiments with apple, quince, and pear seedlings grown under sterilized conditions show that the apple and pear crown gall of the ordinary type, in which there is an absence of side roots or hairy roots, is not contagious. In experiments carried on for 2 years the average result obtained from inoculation of selected apple nursery stock was 10 per cent of diseased plants, with 15 per cent of the control plants affected.

The author states that the apple crown gall is of 2 types, one a more or less woody gall with few or no roots growing from it, while the other form is commonly called hairy root from the numerous side roots that are put out. Galls may or may not occur in connection with this form, and for the present it is considered a distinct disease.

Careful cross-inoculation experiments show that the crown gall of peach, plum, cherry, raspberry, almond, and apricot are identical. The peach and raspberry are most susceptible to wound inoculation, but also become diseased through infected soil. It has been impossible to transfer this disease to the apple, pear, or quince.

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The results from an experiment with 300 2-year-old apple trees, selected with care as to uniformity of size and root system, seem to indicate that the disease has no immediate effect on the duration of the life of the tree where other diseases do not intervene. Field observations bear out the conclusion that the disease does not kill the young trees as often as has been previously believed.

There is frequently found on the roots of apple seedlings, and more rarely on grafted apple trees, a gall of a softer nature, which may prove to be slightly contagious. This is to be a subject for further investigation. On grafted trees most of the galls occur at the lower end of the scion at the point of union with the root. The author states that the work of the previous 2 years is being repeated in different localities, in all 120,000 apple seedlings and root grafts being under observation.

Observations on some vine diseases in Sonoma County, California, O. Butler (*California Sta. Bul. 168, pp. 29, pl. 1, figs. 5*).—Descriptions are given of the red-leaf disease, grape shrivel, and root rot, all of which have been under investigation by the author during the past year or more.

The red-leaf disease, which was first noticed in 1903, is treated at some length, a description being given of the disease, its relationships and resemblance to other diseases pointed out, and the results of experiments for its control presented. The red-leaf disease may affect the shoots, leaves, peduncles, pedicel, and fruit of the vine; the canes on one side or, more rarely, the entire vine may be attacked. The effect that is produced on these different plant organs is described at length. The disease seems to be more or less closely related to folletage, rougeot, and the California vine disease, most nearly resembling the rougeot.

Winter and summer spraying experiments have been carried on for the control of this disease, and while the vitality of the vines seemed to be increased, as shown by the greener appearance of the foliage, yet the treated vines did not show any very great improvement over the untreated ones. The author believes that the red-leaf disease is due to the same causes as folletage and rougeot, namely, a disturbance of equilibrium between the absorption of water by the roots and its transpiration by the leaves. An examination of the soil showed that it was very deficient in phosphoric acid, and it is thought that proper fertilization will help the vines to at least withstand the red-leaf disease.

Grape shrivel is the name given a disease which is characterized by the shriveling of the berries. This shriveling seems to be the most important character of the disease, the symptoms appearing in the leaves being easily referable to drought or imperfect nutrition. The fruit of diseased vines, when it does not shrivel, often ripens prematurely. This prematurely ripened fruit is frequently edible, though at times very distasteful. The disease does not show on the foliage at first, but later is characterized by a discoloration of the leaves, which seems to be caused largely by changes in chlorophyll. No external indications are shown on the vines, but when cut in cross or longitudinal sections the wood and pith show discolorations.

Experiments carried on with a number of varieties, in which different methods of treatment were tested, have led to the conclusion that the cause of grape shrivel is due to imperfect nutrition. It was found that different varieties and different stocks were affected quite differently, and in combating this disease account must be taken of the affinity between the stock and the graft and of the resistance of the stock to phylloxera. The resistance of the stock to the phylloxera may be heightened by fertilization, but if this is not sufficient a change should be made to a more resistant stock. The use of carbon bisulphid in protecting stocks of low resistance from attacks of phylloxera is not under present conditions considered an economic possibility.

The root rot is of fungus origin and in its usual form is recognizable by the soft, watery, yellowish-brown woody cylinder, which is more or less permeated with the mycelium of the parasite. The disease usually takes from 2 to 5 years to kill the

vines, although in some rare cases they have been killed in a single season. The growth of vines affected with the root rot resembles that of vines affected with phylloxera, but in the rapid form of the disease there is no gradual wasting away. The foliage of the vines becomes chlorotic and, if the weather is unfavorable, the leaves rapidly dry up and fall off.

As soon as the disease appears in the vineyard, all badly affected vines should be removed, and the vines surrounding them treated with a 3 per cent solution of copper sulphate or a 7 per cent solution of iron sulphate. This may be done by digging a small basin about the trunk of the vines and pouring into it a gallon or more of either solution. Vineyards once affected with this disease are, unless thoroughly drained, always subject to it. Therefore it is essential that portions of vineyards which are replenished should be treated every 2 or 3 years by one of the methods above described. The root rot is said to attack many varieties, but some seem to be less subject to this rot than others, and such should be employed as stock for grafting.

Fungus diseases of cacao, L. LEWTON-BRAIN (*West Indian Bul., 6 (1905), No. 1, pp. 85–94*).—Descriptions are given of canker of cacao due to *Nectria* sp., die back caused by *Diplodia cacaoicola*, the brown rot of the pods due to the same fungus, and the ripe rot caused by *Phytophthora omnivora*.

The thread blight, caused by an undetermined fungus, is described at considerable length. This disease is said to be very characteristic, the fungus appearing as dark-brown threads or strands, closely appressed to the bark. When young the threads are thin and white, but they become dark after having attained a good attachment to the bark. The fungus spreads by means of its mycelium and can be kept in check only by thorough and constant pruning, to which the author recommends the additional treatment of spraying with a lime-sulphur wash.

A disease of conifers (*Jour. Bd. Agr. [London], 12 (1905), No. 3, pp. 177–179, fig. 1*).—The occurrence on spruce seedlings of the fungus *Herpotrichia nigra* is reported.

The fungus had attacked the leaves causing their destruction, but instead of falling from the dead plants they were bound together by mycelium and remained as a compact brown mass about the branches upon which they had grown. This parasite is said to be most prevalent in nurseries at rather high elevations, and has been reported as attacking spruce, mountain pine, juniper, etc. Its occurrence has been noted in Germany and Norway for some time, but it has only been recently observed in Great Britain. On account of the serious nature of the attack, all diseased seedlings should be collected and burned as soon as observed.

Larch canker (*Jour. Bd. Agr. [London], 12 (1905), No. 5, pp. 307–310, figs. 5*).—A description is given of a wound parasite (*Dasyscypha calycina*) which attacks the European larch to an injurious extent. The canker seems to be especially associated with the larch aphis (*Chermes laricis*), and to prevent injury by the aphis it is recommended that seedlings and young trees should be sprayed with a kerosene emulsion. As a rule, trees under 10 years of age attacked by canker are either killed outright or their growth is badly stunted, and all precautions should be taken against frost injuries, improper situation in planting, insect punctures, etc.

Spraying machines, W. E. BEAR (*Jour. Bd. Agr. [London], 12 (1905), No. 1, pp. 8–18, figs. 10*).—Descriptions are given of a number of forms of hand and power spraying apparatus. The comparative merits and efficiency of the different classes of machines are shown.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Zoological yearbook, 1904, P. MAYER (*Zool. Jahresber., 1905, pp. VIII+640*).—As in former annual reports of this author, brief abstracts are given of the more important investigations published during the year on the different groups of the

animal kingdom. Extensive bibliographies are presented, including titles of the abstracted articles and also numerous less important ones.

The bobwhite and other quails of the United States in their economic relations, S. D. JUDD (*U. S. Dept. Agr., Bur. Biol. Survey Bul. 21, pp. 66, pls. 2, figs. 10*).—The food habits and economic importance of the 7 species of quail known to occur in the United States are discussed in some detail.

Particular attention is given to a study of the bobwhite for the reason that this bird has been more carefully observed and its feeding habits are better known. From an examination of 918 stomachs of the bobwhite it was found that its food consisted of about 83 per cent vegetable matter and 16 per cent animal matter. The vegetable food consists of grain, weed seeds, and other material. A long list is given of the species of weed seeds found in the stomachs of bobwhites. The insect food is discussed according to its systematic position. Similar accounts are presented of the masked bobwhite, California quail, gambel quail, mountain quail, scaled quail, and Mearns quail.

The feeding habits of all the species of quails considered in the bulletin are quite similar, the variations which occur being partly referable to the variable food in the different parts of the country. The bobwhite is the only species which appears in the Eastern States, while the others are generally distributed from Texas to Oregon. The range of these species is continuous along the southern border of the country, but along the northern border there is an extensive interruption in the Great Plains.

Birds known to eat the boll weevil, V. BAILEY (*U. S. Dept. Agr., Bur. Biol. Survey Bul. 22, pp. 16*).—On account of the serious damage caused by the boll weevil in the Southern States, a special effort was made to obtain reliable information concerning birds which feed upon this pest and the amount of assistance which may be expected from them in protecting the cotton crop.

Considering the fact that for the past 12 years the weevil has been steadily spreading over the cotton belt, it appears that birds can not be depended upon to exterminate the pest. As a result of field observations and examination of birds' stomachs in the laboratory a considerable list of birds was determined as feeding upon the weevil. This list includes Carolina wren, titlark, tomtit, western meadow lark, Florida meadow lark, common phoebe, redwing blackbird, white-throated sparrow, western savanna sparrow, brown thrasher, Texas bobwhite, brewer blackbird, cowbird, jackdaw, mockingbird, butcherbird, killdeer, and others of less importance.

The total number of stomachs examined, exclusive of mourning doves and quail, was 570 and of this number 78 contained boll weevils. The weevils were not numerous at the time when the birds were collected. As a result of his study of the question, the author urges the protection of insectivorous birds within the cotton belt.

Bacteria used in the destruction of rats and mice, L. BAHR (*Centbl. Bakt. [etc.], 1. Abt., Orig., 39 (1905), No. 3, pp. 263–274*).—Thus far the bacteria which have been used for the destruction of rats and mice belong to the Coli group.

The bacteria used against rats include the forms cultivated and recommended by Danysz and Issatschenko. Mice are much more susceptible to bacterial infection than rats and succumb to the action of certain bacteria toward which rats are quite immune. A number of feeding experiments were carried out during which rats were fed cultures of Ratin. These cultures produce either an acute infection with enteritis and septicemia without involving the lungs or a chronic infection which exhibits pulmonary symptoms. When Ratin was fed to various species of mice, including *Mus musculus* and *M. agrarius*, the following results were obtained:

White mice, grey house mice, field mice, red mice, and wood mice were nearly all destroyed by the culture. *Mus agrarius*, horse, dog, fowls, cat, and calves 2 months old were not affected in any way by receiving the cultures. Young sucking calves, however, showed considerable weakness accompanied by enteritis, enlarged spleen,

and other symptoms. The author believes, therefore, that some precaution must be observed in the use of these cultures in order to avoid the infection of farm animals.

Entomological department, R. A. COOLEY (*Montana Sta. Rpt. 1904, pp. 225–232*).—Grasshoppers were less injurious than in previous years. A test of the Criddle mixture gave somewhat unsatisfactory results in the hands of ranchers. Some injury was caused to apple trees by a cicada (*Tibicen cruentifera*). Notes are also given on spotted blister beetle, apple aphis, cabbage aphis, field mice, and honey bees.

A circular of information, J. KOTINSKY (*Bd. Comrs. Agr. and Forestry Hawaii, Dir. Ent. Circ. 1, pp. 8*).—The work of the division of entomology is briefly described, with notes on the collection and study of insects.

The western cricket, C. P. GILLETTE and S. A. JOHNSON (*Colorado Sta. Bul. 101, pp. 16, pls. 2*).—*Anabrus simplex* first attracted attention as a pest in Colorado in 1904.

The eggs are deposited about July 1, to a depth of about 1 in. preferably on hills. In some cases 2,000 to 3,000 eggs were counted per square foot of soil. The crickets feed on range grasses, sage brush, cereals, alfalfa, potatoes, garden vegetables, etc. The pests may be herded away from cultivated crops or may be kept away by ditching or fencing. They may also be killed with kerosene, crude oil, or poisoned bait. Plowing, burning, and crushing are also mentioned as remedies. Certain dry hills seem to constitute the permanent home of the pests, but migration takes place when the eggs hatch in large numbers. The insects travel only by daylight.

Leaf hoppers and their natural enemies, R. C. L. PERKINS (*Hawaiian Sugar Planters' Sta., Dir. Ent. Bul. 1, pts. 1, pp. 1–70; 2, pp. 71–85, pl. 1; 3, pp. 86–118, pls. 4; 4, pp. 119–158, pls. 3*).—The parasites of leaf hoppers considered in the first part belong to the family Dryinidæ.

This family appears to confine its attacks to leaf hoppers. A detailed description is given of the method of attack, the effectiveness of these parasites in controlling the leaf hoppers, and other points in their life history. In this discussion the genus Echthrodelphax and other related genera are taken as typical cases. Apparently all leaf hoppers which become parasitized with Dryinidæ are ultimately thereby destroyed. The anatomy of these parasites is discussed, and a systematic account is presented to assist in the identification of species, many of which are described as new.

Agamopsyche threnodes, described in detail in the second part, is parasitic on the sugar-cane leaf hopper and appears to be parthenogenetic. Sometimes more than one larva is found on a single leaf hopper, but perhaps only one reaches maturity. The parasite is referred to a new family described under the name Epipyropidæ, and several other new species of this family are described under the genera Paleopsyche and Heteropsyche.

In the third part the anatomy, systematic position, and life history of the Stylopidæ are discussed, with notes on the effect of their parasitism on leaf hoppers. The male parasites usually have a more serious effect on the host than do the females, and the host is killed. The genera Halictophagus and Elenchus are defined and notes given on the larvæ and puparia of Stylopidæ. Various species of these genera are described, many of them as new.

The fourth part is devoted to a consideration of the family Pipunculidæ. The majority of species in this family belong to the genus Pipunculus, and about 80 species have been recorded for this genus. The flies under discussion are parasitic on various families of Homoptera, including Cercopidæ, Jassidæ, and Fulgoridæ. The anatomy and life history of the genus is discussed in some detail for different stages. A number of species from Australia and Hawaii are described as new, and an analytical table is presented to assist in their ready identification. A brief bibliography of the subject is appended to the bulletin.

Late fall spraying for the San José scale, J. B. SMITH (*New Jersey Stas. Bul. 186, pp. 14, figs. 6*).—Tests were made of the effectiveness of insecticide application

in the fall as opposed to spraying in the spring. In some cases the applications were made before the foliage had fallen. A number of proprietary soluble petroleum insecticides were used as well as lime and sulphur and kerosene-limoid. In general the damage to the foliage even of peach trees was slight, while the scales were effectively destroyed. The author believes that fall spraying is more effective than spring spraying and that the fall should be generally recommended as the proper time for insecticide applications against scale insects.

Experiments during the summer of 1905 indicate that summer applications of insecticides for scale insects can not be depended upon to do more than hold the scale in check while considerable harm to the trees may result. During these tests in summer spraying tobacco extracts, fish-oil soaps, kerosene emulsion, crude and distillate petroleum, kerosene-limoid, and various combinations of lime and sulphur were used. In all cases the effect upon the scales was unsatisfactory or the trees were too much injured.

As a result of the author's experiments along this line it is recommended that trees be sprayed in New Jersey as soon as possible after October 15 or as soon as the leaves begin to mature. In case of bad infestation it may be well to repeat the application within two weeks. With regard to a choice of insecticide the author prefers the mineral oils and several proprietary preparations of these oils in a soluble form. It is urged, however, that none of the oil emulsions should be allowed to get cold and that they should be used in as fresh a condition as possible. In the author's opinion the second choice falls on kerosene-limoid and the third on lime and sulphur combinations. The life history of the scales is also discussed.

Peach insects, R. I. SMITH (*Ga. Bd. Ent. Bul. 17, pp. 55–105, figs. 23*).—This bulletin, as stated by the author, contains practical information prepared to meet the growing demand of peach raisers for directions concerning the control of insects injurious to peach trees. The important insects of peach trees are discussed with detailed notes on their appearance, habits, life history, and control. The more important species considered are San José scale, Putnam scale, cherry scale, peach lecanium, West Indian peach scale, plum pulvinaria, fruit-tree bark-beetle, peach-tree borer, plum curculio, plant lice, and tent caterpillars.

The gypsy and brown-tail moths, A. H. KIRKLAND (*Off. Supt. Suppressing Gypsy and Brown-tail Moths* [*Mass.*], *Bul. 1, pp. 27, pls. 11, figs. 9*).—A copy is given of the recent Massachusetts law relating to gypsy and brown-tail moths. According to this law a superintendent for suppressing the gypsy and brown-tail moths is appointed and an appropriation of $300,000 made available for use during the years 1905–1907. The present bulletin is largely occupied with a description of the gypsy and brown-tail moths and an account of their habits, life history, and distribution with notes on the most effective remedies for controlling them.

Trypeta ludens in Mexico, J. ISAAC (*Sacramento: California State Hort. Com., 1905, pp. 40, pls. 4, figs. 17*).—On account of the importance of this pest and the extent of its ravages in Mexico, the California commission sent the author to investigate the present status of the pest in Mexico and the effectiveness of the means adopted there for its control.

The author visited the greater part of the orange-growing districts of Mexico with this idea in view and collected much information regarding the distribution of the pest, its origin, parasites, and other points of importance to California orange growers. The insect is described in detail in all of its stages. It appears that the life cycle requires about 3 months so that there may be 4 generations per year. In the high lands of Mexico the pest appears not to be very common, while in the State of Morelos it is serious.

The remedies adopted in Mexico for the control of this insect include burning or burial of infested oranges, keeping fowls in orange orchards, spraying with an infu-

sion of *Haplophyton cimicidum*. The natural checks to the spread of this pest are changes of temperature and the presence of parasites. *Trypeta ludens* appears not to be native to Mexico but is probably introduced from some part of South America. It attacks not only sweet oranges but also the mango and guava.

The parasitological commission of Mexico recommends that all infested mangoes, lemons, oranges, and guavas be collected daily and deposited in a suitable place for destruction once a week. Such fruit should be destroyed either by burning or burying to a depth of 20 in.

Insects of the pecan, H. A. GOSSARD (*Florida Sta. Bul. 79, pp. 281–318, pls. 7, figs. 2*).—The present bulletin contains essentially a brief monograph of the important insect pests of the pecan.

Pecan bud-moth (*Proteopteryx deludana*) is one of the most serious of these pests. The insect is described in its different stages and notes are given on its habits. Several natural enemies are known, but their effectiveness is not yet determined. Spraying with arsenicals including Paris green and arsenate of lead did not give encouraging results. The use of lime-sulphur-salt wash was much more satisfactory. Infested pecan buds were fumigated for 30 minutes with hydrocyanic-acid gas. The buds were not injured by the treatment, but the moths seemed not to be destroyed. Not more than 15 to 20 per cent of the buds survived on account of later infestation. In nursery practice it seems to be necessary to remove the cocoons with a knife.

The pecan case-borer (*Acrobasis nebullela*) is also a serious pest and is described with notes on its habits and life history. This pest is also attacked by parasites and birds. In the control of this insect it appears that the remedies most successful in use against the pecan bud-moth are also best for use against this species. Notes are also given on the appearance, habits, life history, and means of combating species of Catocala, *Sesia scitula*, *Datana integerrima*, fall webworm, twig girdlers, oak pruner, hickory-nut weevil, hickory bark-borer, white ant, cottony maple scale, etc.

Insects injurious to forests, A. L. HERRERA (*Com. Par. Agr.* [*Mexico*] *Circ. 29, pp. 4, figs. 8*).—Particular attention is given in this circular to a discussion of Dendroctonus and related forest insects with reference to artificial insecticides and methods which have been found to be effective in controlling these pests and also to their natural enemies.

Texas fever ticks (*Oklahoma Sta. Rpt. 1905, pp. 28–30*).—Attention is called to those features in the life history of cattle ticks which makes it possible to exterminate the tick by a system of rotation of pastures and direct treatment of cattle for tick infestation. The great advantages of tick extermination are briefly discussed.

Means for the destruction of mosquitoes, A. F. MANKOWSKI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 39 (1905), No. 3, pp. 277–279, figs 3*).—Brief reference is made to experiments previously carried out by other investigators in the infection of mosquitoes with various species of bacteria.

In the study of mosquitoes in Bessarabia a mite was found infesting mosquitoes under the wings and various other parts of the body. An examination of the parasites showed them to be undoubted mites about $\frac{3}{8}$ mm. long. From one to six parasites were found on each infested mosquito, and about 30 per cent of all mosquitoes studied were infested. The importance of this parasite appears to be quite great, since the number of mosquitoes and the extent of malaria were considerably reduced during the year.

Report of the inspector of fumigatien appliances, 1904, P. W. HODGETTS (*Toronto: Ontario Dept. Agr., 1905, pp. 11, figs. 3*).—The practices of various nurserymen with regard to transplanting and handling of stock are briefly described. The effects of severe winter cold upon San José scale were studied. It was found that the severity of winter had little effect in controlling the numbers of the scale. The insect was more seriously affected by cold on peach and plum trees than on apple trees. In

the author's opinion the lime and sulphur wash is the best remedy for the San José scale.

Annual report of the Beekeepers' Association of the Province of Ontario for 1904 (*Ann. Rpt. Beekeepers' Assoc. Ontario, 1904, pp. 87, figs. 4*).—At the 25th annual meeting of the Ontario Beekeepers' Association, held in Toronto November 15–17, 1904, a number of papers were read which may be briefly noted in this connection.

The general status of beekeeping was discussed in the president's address by J. W. Sparling. A paper on extracted honey, read by M. Pettit, suggested that all white honey should be removed by the first of August in order to avoid any mixture of dark honey. In the production of extracted honey it is recommended that the weather, climate, and locality be studied in order to choose the most suitable breed of bees and style of hives. Honey should not be extracted until well ripened, and should be sealed up as soon afterwards as possible.

F. C. Harrison spoke on the diseases of bee larvæ, calling attention to the principal means by which contagion is spread among bees, and giving detailed notes on foul brood, black brood, pickled brood, chilled brood, and starved brood. It is thought that some of these terms may be synonymous, as it seems unlikely that all are distinct diseases.

Papers were also presented on A Season with the Bees and How to Manage Them, by A. E. Hoshal; The Influence of Bee Journals, by W. J. Craig; Queens and their Influence on Bee Culture, by W. Z. Hutchinson; Foul Brood, by H. J. Sibbald; Winter Losses, by W. F. Holtermann; Sanfoin as a Bee Plant, by J. Fixter; Prevention and Control of Swarming by Means of the Hedden Hive, by J. D. Miller.

J. Fixter presented the results of experiments upon methods of protecting hives for outside wintering, a study of cellars for wintering bees, methods of introducing queens, and feeding with honey and sugar in winter quarters.

Bee products in Arizona, R. H. Forbes (*Arizona Sta. Bul. 51, pp. 523–532, figs. 2*).—Statistics are presented regarding the present status of apiculture in Arizona. A list is given with times of blooming of the more important honey crops of the Territory. At present, alfalfa is less available than formerly as a honey crop, on account of the fact that it is cut at an earlier stage than in previous years, and also on account of the prevalence of the alfalfa butterfly which feeds upon the honey. Determinations were made of the sugars contained in the flowers of alfalfa and certain native bee plants.

The quality and composition of samples of Arizona honey are also discussed. The average amount of moisture in honey from Arizona was found to be about 2 per cent less than that of eastern honey. The ash was of about normal quantity and composition. Analytical data are presented regarding honey samples and notes are given on adulteration and by-products. The honey of Arizona contains a maximum amount of sugar and very little nonsaccharine substances and is usually of desirable color and flavor. In liquefying honey it is recommended that the process be carried on at a comparatively low temperature in order to avoid injuring the quality.

Sericulture, P. Vieil (*Sériculture. Paris: J. B. Baillière & Sons, 1905, pp. VIII+360, figs. 50*).—This volume is one of the series which constitute the agricultural encyclopedia published under the direction of G. Wery.

The subject is discussed under 7 heads, including the history of sericulture; anatomy and physiology of the silkworm; diseases of the silkworm; rearing silkworms; care and production of the silkworm eggs; the qualities, treatment, and manufacture of silk; and artificial silks, including silks from other sources than the true silkworm. In an appendix the author discusses the culture of mulberries.

The silk-growing season of 1904, G. McCarthy (*North Carolina Sta. Rpt. 1904, pp. 55, 56*).—It is reported that public interest in silk growing continues to increase.

A number of silk growers' associations have been formed, silk manufacturing plants have been established, and instruction given in silk raising in industrial schools. It is believed that when properly carried on, the business of silk raising may bring reasonably profitable returns to children and adults who are incapable of doing severe manual labor.

FOODS—HUMAN NUTRITION.

Studies of the digestibility and nutritive value of bread and of macaroni at the University of Minnesota, 1903–1905, H. SNYDER (*U. S. Dept. Agr., Office Expt. Stas. Bul. 156, pp. 80, pls. 4, fig. 1*).—Continuing earlier work (E. S. R., 15, p. 63), digestion experiments were made with different grades of flour ground from Oklahoma hard winter wheat and Oregon soft winter wheat. In 18 experiments with men, white (straight-grade) flour was more completely digested than either Graham or entire-wheat flour, and yielded a larger amount of digestible nutrients and available energy.

In 3 digestion trials, in which finely pulverized bran was added to white flour in the same proportion as is removed in milling, the addition of the bran lowered the digestibility of the flour so that a smaller amount of digestible nutrients and available energy was obtained from the bran flour than from the white flour with which the bran was mixed.

In 3 digestion trials, in which finely pulverized wheat germ was added to white flour in the same proportion as is removed in milling, the addition of the germ did not materially change the digestibility of the flour, and the amount of total digestible nutrients and available energy in the germ flour and the white flour was about the same. There was no material gain in total digestible nutrients by the addition of the germ to the white flour. The germ flour produced a smaller sized, sweeter, but less porous loaf than the white flour. Because of its fermentable character wheat germ is excluded from white flour.

Studies were also made of the digestibility of macaroni made from American-grown durum wheat, of breakfast foods made from the same sort of wheat, and also of the changes which take place in semolina in macaroni making.

According to the author, during the process of manufacture of macaroni water is removed in drying the macaroni and the starch and gluten apparently undergo a slight hydration. When macaroni is cooked in water about 2.25 per cent of the soluble matters present are extracted, which suggests that as little water as possible should be used in cooking the macaroni when strict economy is desirable.

As shown by experiments with healthy men, the macaroni used had approximately the same digestibility and supplied about the same amount of nutrients, pound for pound on a dry-matter basis, as bread made from straight-grade flour. Consuming either large or small amounts of bread made from durum wheat flour with the macaroni exercised no appreciable effect upon the digestibility of the nutrients and the availabillty of the energy present.

The durum wheat breakfast food resembled quite closely in composition the macaroni made from similar wheat. It was not quite as thoroughly digested, though its digestibility was fairly high as compared with many vegetable foods. The observed differences in digestibility of the breakfast food and the flour products are undoubtedly due to methods of manufacture, the flour products being rather finely ground and therefore in a condition favorable for the action of the digestive juices.

The contamination and adulteration of bread and of the milling products employed in its preparation, H. STIEGELER (*Pure Products, 1 (1905), No. 5, pp. 245–251*).—Weed seeds, mineral adulterants, inferior starches, and other adulterants of wheat and bread are spoken of, and methods of detection briefly noted.

Gluten bread (*Lancet [London], 168 (1905), No. 4260, p. 1075*).—An analysis is briefly reported.

Malt extract in bread making, R. L. CORBY (*Pure Products, 1 (1905), No. 4, pp. 187-189*).—The effect of substituting malt extract for cane sugar in bread making is discussed, the data presented being on the whole unfavorable to this practice.

Wheaten flour, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada], Bul. 98, pp. 14*).—Data are given regarding the analysis of 75 samples of flour purchased in open market in different districts of the Dominion of Canada and 11 samples of known characteristics which were examined for purposes of comparison.

No indication was found of adulteration with mineral matter or with other and lower priced grains than wheat. In the case of part of the samples the analyses were more detailed than with the remainder, special attention being paid to the material soluble in alcohol, i. e., reducing sugar or dextrose, sucrose, nonnitrogenous substances, and gliadin.

In addition to other constituents the amount of material extracted by water after treatment with alcohol was also determined. The extraction with alcohol was carried on in Macfarlane tubes, the flour sample being distributed through crysotile fiber and the tubes furnished with an asbestos filtering bed. The gluten and gliadin content of the flour samples and related topics are discussed.

Cereal foods, L. H. MERRILL (*Maine Sta. Bul. 118, pp. 117-135*).—The classification of cereal breakfast foods, their composition, manufacture, relative economy, etc., are discussed and digestion experiments reported in which several different brands constitute varying proportions of the diet. The following table summarizes the experimental data:

Coefficients of digestibility of cereal breakfast rations and cereal breakfast foods alone—Experiments with men.

Diet.	Number of experiments.	Total organic matter digested.	Protein digested.	Proportion of total energy in digested food.
		Per cent.	*Per cent.*	*Per cent.*
Rolled oats with a mixed diet	17	96.2	90.1	95.3
Rolled oats with a simple diet	16	95.4	84.7	94.2
Rolled oats alone	16	92.3	78.4	89.8
Rolled wheat with a mixed diet	3	96.2	93.2	95.3
Rolled wheat with a simple diet	3	95.2	91.6	94.6
Rolled wheat alone	3	92.4	85.0	90.7
Force with a mixed diet	3	95.7	92.7	95.2
Force with a simple diet	3	94.6	89.6	91.1
Force alone	3	90.4	76.1	88.8
Grape-nuts with a mixed diet	3	96.6	92.8	95.6
Grape-nuts with a simple diet	3	94.0	87.6	93.1
Grape-nuts alone	3	91.7	76.1	89.4
Shredded whole wheat with a mixed diet	3	95.5	92.1	94.5
Shredded whole wheat with a simple diet	3	92.8	84.1	91.4
Shredded whole wheat alone	3	87.7	57.7	84.1
Hecker's hominy with a mixed diet	4	97.1	88.9	96.3
Hecker's hominy with a simple diet	4	97.3	83.6	96.4
Hecker's hominy alone	4	....	74.5	94.4
Granulated corn meal, mixed diet	2	97.2	89.0	96.9
Granulated corn meal, simple diet	4	97.2	82.3	95.9
Granulated corn meal alone	4	....	73.2	93.1

"Where the cereals were used with a mixed diet they had but little apparent effect upon the digestibility of the total food. As regards the digestibility of the total organic matter, the corn products made a very favorable showing. At the same time a larger proportion of the energy of the food was utilized by the body than where the wheat and oat products were used. On the other hand, the use of the corn foods seemed to depress the digestibility of the protein of the total food.

"When the simple diet was used, the corn products again made a favorable showing as regards both total organic matter and energy, least favorable of all, however, in digestibility of protein. If we value these foods in proportion to the digestibility of their protein when used with a mixed diet, we must place rolled wheat first and the corn products last.

"When the digestibility of the cereals alone is calculated, more striking results are obtained. It will be noticed that the rolled wheat now ranks first, not only in the digestibility of the total organic matter, but also with respect to the protein. The rolled oats rank next, and the corn preparations and shredded wheat the lowest of all.

"One of the most noticeable differences in these cereal foods is found in the digestibility of the protein when the cereal is eaten with a simple diet. This difference is most marked in the various wheat products, especially when the results are calculated to the cereal alone."

The nitrogen content of barley and malt, PRIOR (*Allg. Ztschr. Bierbrau. u. Malzfabrik., 32 (1904), p. 231; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 7, pp. 426, 427*).—The author discusses the relationship between nitrogen content and the quality of malt, and outlines experiments which he proposes to undertake.

The distribution of nitrogenous material in barley, E. JALOWETZ (*Allg. Ztschr. Bierbrau. u. Malzfabrik., 32 (1904), pp. 259, 260; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 7, p. 426*).—According to the author's investigations, the upper part of the grain (water free) contained 17.75 per cent protein, the middle portion 11.19 per cent, and the lower end 14.44 per cent. The data are discussed with relation to malt making.

The purin bodies of food stuffs, I. W. HALL (*Philadelphia: P. Blakiston's Son & Co., 1904, 2. ed., rev., pp. 202 + XIII, pls. 2, fig. 1*).—In this second and revised edition the author states that part of the volume has been rewritten and new matter added, including the results of analyses, experimental and bibliographical data, etc.

Among the questions discussed are the chemistry and physiology of food purins, methods of estimating food purins and their action, the fate of such bodies in metabolism, the effect of drugs upon the elimination of purin bodies, purins in relation to disease, and related topics, the volume as a whole being a digest of his own investigations and those carried on by others. The author has devised an improved method of estimating purin bodies and reports data showing the amount present in different food products.

Some of the general conclusions follow: "Of the known purin bodies, hypoxanthin, xanthin, guanin, and the methyl-xanthins, caffein and theobromin are found in food stuffs, and uric acid and traces of xanthins and methyl-xanthins are met with in the urine. . . . In food stuffs, the purin bodies occur in 2 forms, 'free' and 'bound.' Both the glandular and muscular tissues contain approximately equal amounts of 'free-purins,' but the glandular tissues yield very large and the muscles only very small quantities of bound-purins (nucleins).

"The estimations of the purin bodies contained in meats show that considerable quantities are present, but that little difference exists between the amounts contained in white and dark meats. Certain vegetable foods have been found to contain purin bodies. Amongst these are peas, beans, oatmeal, asparagus, and onions. This furnishes a reason for the high uric acid excretion which follows their ingestion. From several varieties of beer and porter purin bodies have been isolated, and their percentage amounts estimated."

Urinary purin occurs principally in the form of uric acid. In experiments reported the amount was increased by feeding fish, fowl, beef, beans, and beer. "The increase of urinary purin reflects the metabolic activity of the individual in regard to nucleins. The feces may contain unabsorbed nucleins as well as certain purin sub-

stances from the digestive juices and cell nuclei, and estimations of these bodies should be included in all metabolic experiments.

"When the 'free' purins are injested, they are rapidly oxidized and decomposed. About 50-60 per cent of hypoxanthin leaves the body as urinary purin (principally uric acid) within 4-6 hours, and the same percentage of uric acid appears in the urine after 8-10 hours. The bound purins, however, take 1-2 days before they are fully excreted. The remaining 50 per cent of the food purin is excreted as urea, or as bodies intermediate between uric acid and urea.

"By the quantitative estimations of purin bodies in food stuffs an exact forecast of the exogenous urinary purin is possible, and its amount can be limited when necessary by prescribing a certain diet. . . . The endogenous purin is partly derived from leucocytes, but mostly from the cell changes which result in the maintenance of bodily functions. . . . Uric acid is a necessary result of normal nuclein metabolism. In disease it is symptomatic of conditions which hinder or prevent its solubility and excretion, and does not itself cause the lesions which accompany uricacidæmia." The volume contains an extended bibliography of the subject.

Heat values and food values, H. P. Armsby (*Reprinted from Arch. Ped., 22 (1905), Feb., pp. 124-130*).—The author discusses body temperature, the production and liberation of heat in the animal body, and related questions.

He points out that the production of heat in the animal body is incidental to the vital processes, and the heat so produced may to a considerable degree be regarded as an excretum, the body temperature within limits being due to a condition of equilibrium between heat production and heat elimination. "It is important to note, however, that it is not until the original chemical energy has served its physiological purposes that it takes the form of heat. It is not first converted into heat, which is then further converted into muscular or other work; but, on the contrary, it first gives rise to the muscular or other energy required, and the latter, in performing its functions, is degraded into heat.

"In other words, we have no evidence that the animal body is a form of heat engine. It is evident, then, that at least a part of the heat production of the animal is incidental to other purposes. At the same time, of course, the heat thus produced is available to maintain the body temperature, and the question at once arises whether the supply thus incidentally provided is sufficient, or whether additional body tissue must be metabolized simply for the sake of producing heat."

In order to maintain approximately the same body temperature, heat must be eliminated at the same average rate at which it is produced, the three principal ways of eliminating heat being by conduction, radiation, and by the vaporization of water. These processes are collectively referred to as physical regulation, and act through a considerable range of temperature. "Necessarily, there is an upper limit beyond which these means of getting rid of heat become insufficient, and the fatal heat stagnation begins. As we go below this limit the tendency of a falling temperature to withdraw heat from the body more rapidly is met by changes the reverse of those just . . . [referred to], and by their means the outflow of heat is kept practically constant and there is no increase in the amount of heat produced, but rather a slight decrease.

"As we follow this experimentally, however, we reach a point, known as the critical temperature, at which the possibilities of this physical regulation appear to reach their lower limit. The facility with which the surface of the body eliminates heat can not be further reduced, and a continued reduction of the external temperature is met by a marked increase in the heat production—the so-called 'chemical' regulation. The answer to our initial question, then, is that at or above the critical temperature the incidental heat production due to the internal work of the body suffices, or more than suffices, to maintain its normal temperature, while below that point additional body material must be oxidized for this special purpose."

The increased production of heat after food is taken, due to the processes of digestion, the different amounts of heat produced by different foods, and related questions are spoken of. The author points out that the amount of energy required to digest different foods varies, and that this must be taken into account in considering their true energy value.

"The food value of a nutrient as a source of energy to the organism is not measured by the total energy which it can liberate as heat in the body, but by the part of this energy which is available to the organism for physiological uses. The remainder of the 'fuel value' simply serves to increase the generation of heat in the body, a result which may be advantageous or the reverse, according to the surrounding conditions."

Concerning the natural feeding of infants, M. RUBNER and O. HEUBNER (*Ztschr. Expt. Path. u. Ther., 1 (1905), No. 1, pp. 1-25*) —In the experiments reported a healthy infant was under observation for 8 months from birth, and data are recorded regarding the amount of food eaten, the gains in weight, etc. During 5 days, when the child was 5.5 months old and weighed nearly 10 kg., the income and outgo of carbon and nitrogen were determined

For 4 days the food consisted entirely of mother's milk. On the fifth day the child was given a tea which furnished so little nutritive material that this was essentially a fasting period. The composition and energy value of the food and excreta were determined. The respiratory products were measured with a respiration apparatus especially constructed for the experiments, the total amounts of carbon dioxid and water excreted in 24 hours being calculated from the amounts determined for shorter periods.

Disregarding the first day of the milk period, the average amount of nitrogen taken per day was 1.99 gm., the amount excreted in the urine 1.13 gm., and in the feces 0.4 gm. In other words, there was an average daily gain of 0.46 gm nitrogen. The daily diet furnished 63.7 gm. carbon The average amount excreted in the urine was 1.41 gm., in the feces 2.71 gm., and in the respiratory products 61.68 gm., which is equivalent to an average daily loss of 2.1 gm. carbon. During the tea or fasting period the diet contained no nitrogen nor carbon. The total amount of nitrogen excreted in the urine was 1.18 gm. In other words, the body lost this amount in 24 hours. The urine contained 1.29 gm. carbon and the respiratory products 59.5 gm., i. e., there was a loss of 60.79 gm.

The authors discuss the gain in nitrogen and the loss of carbon on the experimental days in which food was taken and explain the apparent discrepancy on the basis of changes in the water content of the body. A comparison of the amount consumed and furnished by the oxidation of food materials with the quantities excreted shows that actually there was a considerable gain of water.

Deducting the energy value of the excretory products from the total amount supplied by the food, the authors calculated the amount of energy metabolized per day, which was equivalent to 67.6 calories per kilogram body weight, or 1,219 calories per square meter surface area. Examination of the experimental data showed that the body used the nitrogen of the diet very economically.

In connection with the experiments some studies were made of the assimilation of nitrogen on a diet of mother's milk as compared with cow's milk. It was calculated that in the case of mother's milk 0.135 to 0.161 gm. nitrogen in the form of true protein was required per kilogram body weight as compared with 0.530 gm. nitrogen in the case of cow's milk. On the basis of the experimental data the amount of nitrogen required is discussed with reference to the diet of both infants and adults, and the fact noted that the quantity may be small provided the energy value of the diet is sufficiently high.

Concerning the mechanism of stomach digestion, P. GRÜTZNER (*Arch. Physiol. [Pflüger], 106 (1905), No. 10-12, pp. 463-522, figs. 13*).—In experiments undertaken

to study the mechanics of digestion animals were killed and the stomachs frozen, the experimental method being described in full.

Some of the author's conclusions follow: It was found that the stomach contents was divided into layers, in general the food which was taken last being surrounded by food taken earlier and thus protected for a time from contact with the stomach walls. The left region of the stomach, the so-called fundus (pars splenica), is the storage portion, and food remains here for hours without coming in contact at all with the gastric juice and during this time the amylolytic action of saliva is continued.

At the same time peptic digestion is going on in the prepyloric and pyloric portions of the stomach, the digestive secretions and muscular contractions being different at different points. In other words, the stomach contents is not at all uniform.

The secretion of ferments and other questions were also studied and discussed.

On the products of digestion of the proteolytic spleen enzym acting in an alkaline medium, E. P. CATHCART (*Jour. Physiol., 32 (1905), No. 3-4, pp. 299-304*).—Using lieno α-protease of Hedin, the following substances were isolated from the products of digestion of coagulated blood serum: Histidin, inactive arginin, lysin, tyrosin, leucin, alanin, amido-valerianic acid, α-pyrrolidin carboxylic acid, glutamic acid, phenylalanin, and ammonia. Aspartic acid was regarded as probably present, as it is formed in large quantity when fibrin is digested by the same enzym.

The influence of fasting and feeding upon the respiratory and nitrogenous exchange, M. S. PEMBREY and E. I. SPRIGGS (*Jour. Physiol., 31 (1904), No. 5, pp. 320-345*).—The experiments reported were carried on with white rats.

Some of the conclusions drawn follow: "During fasting the respiratory exchange quickly reaches a minimum, and then remains remarkably constant during the prolongation of the fast. . . . The effect of food rich in carbohydrates upon the respiratory exchange is well marked within an hour, and steadily increases during the next 2 or 3 hours. The increase in the output of carbon dioxid varied according to the conditions from 14 to 97 per cent of the minimal discharge during hunger." In the majority of cases there was an increase in the absorption of oxygen which ranged from 9 to 35 per cent.

"The increase in the discharge of carbon dioxid after a meal rich in carbohydrates appears to be due to a general increase in the metabolic processes of the body, including the formation of fat, and not solely to the work of digestion. . . . A fast preceding a meal serves as a marked stimulus to the assimilation of food. . . . The respiratory quotient is probably the resultant of quotients above and below the theoretical values for the combustion of proteids, carbohydrates, and fats."

In connection with part of the work an attempt was made to study nitrogen metabolism, but this phase of the work was not continued, as, according to the authors, it was not possible to estimate correctly the percentage composition of the living animal from data obtained by the analysis of a control specimen.

Concerning the metabolism of athletes, H. LAVONIUS (*Skand. Arch. Physiol., 17 (1905), No. 1-2, pp. 196-204*).—The studies reported were made with 2 circus performers.

In the 6 days covered by the investigation the daily diet furnished on an average 217.9 gm. protein and 5,070 calories of energy with one of the subjects and 182.2 gm. protein and 4,254 calories of energy with the other. The subjects worked only 2 or 3 hours each day, but the work was very severe. The body weight in each case was about 84 kilograms. In the 2 cases fat supplied 47.6 and 44.8 per cent, respectively, of the total energy of the diet, quantities which the author considers very unusual. In connection with the investigation the income and outgo of nitrogen were determined.

The toxin and antitoxin of fatigue, W. WEICHARDT (*München. Med. Wchnschr., 51 (1904), Nos. 1, pp. 12, 13; 48, pp. 2121-2126*).—The author states that from the

flesh of guinea pigs dead from fatigue he was able to extract a body which injected into guinea pigs and other animals caused all the symptoms of fatigue.

This body was isolated and found to be very unstable in character, and the author considers it a true toxin. When injected into the circulation of horses an antitoxin was produced which in vitro or in animals counteracted the toxin. As shown by a number of experiments the antitoxin can be taken by man without harmful results. In connection with the report of the experiments, the author discusses the characteristic symptoms of fatigue, its effect upon the body temperature, the production of the antitoxin in the body, and related questions.

The relation of cookery to digestion, BERTHA H. BACHELLER (*Quart. Rpt. Kans. Bd. Agr., 24 (1905), No. 93, pp. 234–237*).—A summary of data on changes which take place in cooking different nutrients and related topics.

Shellfish and the bacilli of typhoid (*Brit. Food Jour., 7 (1905), No. 75, pp. 48, 49*).—A note on E. Klein's investigations for the Fishmongers' Company of the time required by oysters and other shellfish to clear themselves of bacilli.

The phosphorescence of eggs and potatoes, A. NESTLER (*Umschau, 9 (1905), No. 13, pp. 255, 256*).—On the basis of the investigations by H. Molisch,[a] the author discusses the phosphorescence sometimes observed in food products, which is due to *Bacterium phosphoreum*. Methods of cultivating this micro-organism are spoken of. Its development, it is stated, does not render the food products harmful.

Some tea curiosities, L. LODIAN (*Tea and Coffee Trade Jour., 8 (1905), No. 5, pp. 212–214, figs. 5*).—Russian tea tablets and other unusual forms of tea are described.

Tea boquets and scented tea, L. LODIAN (*Tea and Coffee Trade Jour., 9 (1905), No. 5, pp. 243–245, figs. 3*).—Compressed tea and other standard and fancy Russian teas are described. It is stated that tea dust may be profitably compressed into blocks.

The examination of the feces, I. S. WILE (*N. Y. Med. Jour. and Phila. Med. Jour., 81 (1905), pp. 475–478; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 5, p. 277*).—A summary of data on the composition of feces in health and disease.

Food investigations, V. K. CHESTNUT (*Montana Sta. Rpt. 1904, pp. 236, 237*).—Cooperating with M. E. Knowles, some studies were made of meat preservatives and their occurrence in sausage. Preservatives were found in excessive amounts in several samples, but their use was discontinued when the attention of the sellers was directed to the matter. Brief notes are also given regarding a case of poisoning due to eating freshly opened canned salmon, which apparently contained ptomaines.

Report of State analyst, R. E. DOOLITTLE (*Ann. Rpt. Dairy and Food Comr. Mich., 1904; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 5, pp. 288, 289*).—Of the 1,279 samples of food products examined under the provisions of the State pure-food law 442 samples were adulterated or sophisticated. In connection with the work special attention is given to the use of methyl alcohol in flavoring extracts and to terpenless lemon extract.

Report of work in food laboratory, H. E. BARNARD (*N. H. Sanit. Bul., 2 (1905), No. 7, pp. 108–113*).—In compliance with the State pure-food law 363 samples of canned goods, cider vinegar, cheese, condensed milk, extracts, honey, maple sugar and sirups, molasses, meat products, etc., were examined, of which 164, or 45.2 per cent, were found to be adulterated or to vary from the legal standard. Twenty-three of the 41 samples of sausage and other meat products examined contained borax or sodium sulphite. A sample of cereal coffee was found to contain a large percentage of coffee in addition to roasted cereals.

Fifth report on food products for 1904, B. W. KILGORE (*Bul. N. C. Bd. Agr., 25 (1904), No. 12, pp. 62*).—Of the 347 samples of flour, breakfast foods, meats, canned

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[a] Sitzber. K. Akad. Wiss. [Vienna], Math. Naturw. Kl., 114 (1905).

goods, dairy products, etc., examined, 59 samples, or 17 per cent, were adulterated or sophisticated.

No adulteration was detected in the case of the flour, breakfast food, canned fruit, cocoa, butter, cheese, and whiskies examined. The following special articles in nearly every case give the details of analyses made during the year under the State pure-food law and discuss the results: Chemical Preservatives; Canned Meats; Examination of Canned Fish and Oysters; The Examination of Canned Fruits and Vegetables; Prepared Mustards and Salad Dressings; Whisky; and Examination of Flour, by W. M. Allen; Cocoa and Chocolate, Butter, and Cheese, by J. M. Pickel; Breakfast Foods, by C. D. Harris.

ANIMAL PRODUCTION.

Investigations at the sugar experiment station laboratory for 1904, C. A. Browne, Jr. (*La. Planter, 34 (1905), No. 15, pp. 236–240, fig. 1*).—In connection with the work carried on under the author's direction, analyses have been made of a number of feeding stuffs containing molasses.

In his opinion, one of the best materials which can be used to absorb molasses is bagasse. The sample of bagasse molasses feed, i. e., molascuit, analyzed contained 20 per cent of bagasse and 80 per cent molasses. The rind of the cane, it is pointed out, is not so well adapted as the pith for making such a mixture, as it has only about one-sixth of the absorptive power of the pith and is also much harder to digest. It is also pointed out that under local conditions, cotton-seed meal added to a mixture of bagasse and molasses would compensate for the deficiency of protein in the mixture.

A number of different sorts of Louisiana molasses were analyzed and extensive studies of the solids other than sugar in cane molasses, the fermentation of cane products, and of the effect of temperature upon the polarization of raw cane sugars are also reported, as well as the results of physiological experiments upon the maturing of cane.

In the author's opinion, the results obtained with different sorts of molasses show that "the process of manufacture has much to do with the differences in composition. The open-kettle molasses, being less exhausted than the other grades, has naturally more sucrose and less impurities, such as gums, acids, ash, amids, etc. The diffusion molasses, on the other hand, has a larger percentage of impurities, owing to the greater extraction of these ingredients from the bagasse. The effect of liming upon the different samples is very pronounced, those which have received the heaviest treatment being the highest in gums and combined acids. A large part of those compounds which we designate as gums and acids in molasses do not come from the cane, but are the result of the action of lime upon the glucose of the juice." The organic bodies, other than sugar in molasses, it is stated, are largely gums, nitrogenous compounds, acids, and caramel-like substances.

The different gums found in cane molasses, according to the author, may be divided into three classes, namely, those derived from the cane, such as xylan, araban, and galactan, those resulting from fermentation changes in the juice, sirup, or molasses, such as dextran, mannan, and cellulan, and those produced by the action of the clarifying agents during the process of manufacture. The third class would include a number of dextrinoid bodies which seem to result largely from the action of liming upon the glucose of the juice, but the exact nature of these substances has not been definitely determined.

Formic, lactic, and amido acids and butyric and a number of other fatty acids higher than butyric were identified in molasses. Such bodies as glycerin, mannite, lecithin, and cholesterin have also been found occasionally. A body for which the name dimethylketol was proposed was found in a sample of sour molasses. A study

of dried molasses scum showed the presence of 10 per cent water, 11.30 per cent chitin, 31.63 per cent protein, 27.50 per cent fat, 14.00 per cent carbohydrates, and 5.58 per cent ash. The fat was similar in some of its properties to butter fat.

Analyses are reported of cane juice before and after freezing, and the question of injurious effects of frost on cane is considered. As regards the effect of temperature upon the polarization of cane juice, the results obtained indicate "first, that a falling off in the polarization of raw sugars between ports in tropical and temperate latitudes may be due to differences in the temperature of polarization as well as to deterioration, and, second, that tables for correcting polarizations to a standard temperature, based upon variations in the rotation of sucrose alone, are of no value in the polarization of raw-cane products. These observations hold, however, only for single polarization, for if the sugars are double polarized, as by the Clerget method, the levulose error is entirely obviated."

In connection with the physiological experiments on maturing cane, data are reported regarding the juice of stubble canes. Other work of the year is also referred to briefly.

Report upon the properties and utilization of rice oil, C. A. BROWNE, Jr. (*La. Planter, 34* (*1905*), *No. 22, pp. 352, 353*).—Since rice bran and polish are frequetly undesirable as feeding stuffs, owing to the development of acid from the oil present, methods of improving the feeding qualities of the rice by-products were studied.

It was found that heating the bran to 200° F. or over destroyed the ferment which decomposes the rice fat. However, as the rice feed possesses laxative properties, it seemed desirable to remove the oil, and tests showed that this could be satisfactorily accomplished with the aid of a solvent. The oil obtained differs decidedly in character and properties from that of other cereals. It is semisolid at winter temperature, begins to melt at about 75° F., and becomes perfectly transparent at 117° F. At ordinary summer temperature the oil separates into solid and liquid portions.

A sample of rice oil extracted with ether from old bran had the following constants: Specific gravity 0.8907, melting point 24°, acid number 166.2, saponification number 193.5, ether number 27.3, iodin number 91.65, Reichert-Meissl number (volatile acids) 1.1, mean molecular weight of insoluble fatty acids 289.3, melting point of insoluble fatty acids 36°. Some determinations made with a sample of rice oil representing a large extraction gave about the same values. The oil contained about 1 per cent of matter which did not saponify and which in microscopical appearance and physical properties resembled phytosterol. A small amount of phosphoric acid was also present equivalent to 0.5 per cent lecithin.

"The fact that rice oil contains fats of high melting point and fatty acids of high mean molecular weight would indicate the probable presence of such higher fatty homologues as arachidic, behenic, or lignoceric acids. Glycerids of the volatile fatty acids are present only in traces." Since rice oil becomes rancid so readily, the author does not consider that it would prove a satisfactory culinary fat. He suggests that the solid portion which separates at ordinary temperature and constitutes 20 to 50 per cent of the total, would prove useful for candle making and the liquid portion for soap making.

According to his estimates, the present rice crop of Louisiana would yield about 500,000 gal. of rice oil annually. It is pointed out that the utilization of this by-product would prove important, especially when it is remembered that removing the oil improves the feeding qualities of the rice by-products.

The composition of some of the concentrated feeding stuffs on sale in Florida, A. W. BLAIR (*Florida Sta. Bul. 80, pp. 19*).—A number of concentrated feeds on sale in Florida were analyzed to determine whether or not the existing conditions of affairs warranted a State feeding-stuff law.

The goods examined included wheat, bran, shorts, and middlings, cotton-seed meal, crushed cotton seed, corn-and-cob meal, ship stuff, Mack's mule feed, and a number of commercial and mixed feeds. In a table which summarizes the composition of a number of American feeding stuffs, the author also reports analyses of beggarweed hay, and wire-grass hay. The author concludes that, "judged by the samples examined, a large proportion of the concentrated feeding stuffs on the Florida market is, of an inferior quality."

Commercial feeding-stuff law, B. E. McLin (*Fla. Mo. Bul. Dept. Agr., 15 (1905), No. 2, pp. 39–50*).—Data are quoted regarding the composition of a number of common American commercial feeding stuffs, and the Florida feeding-stuff law, which went into effect in August, 1905, is given. The law provides for the inspection and labeling of commercial feeding stuffs, and imposes a tax of 25 cts. per ton on such goods. Penalties are provided for infringement.

The State commissioner of agriculture is entrusted with the carrying out of the provisions of the feeding-stuff law.

Commercial stock feed, E. E. Rose (*Fla. Mo. Bul. Dept. Agr., 15 (1905), No. 3, pp. 58–67*).—Data noted from another publication (see above) are summarized regarding the need of a State pure-food law, and figures are quoted showing the average composition of a number of common commercial feeding stuffs.

Inspection of feeding stuffs (*New York State Sta. Bul. 268, pp. 285–322*).—The list of feeding stuffs licensed for sale in New York in 1905 is given and the results of analyses made under the provisions of the State feeding-stuff law of a number of samples of cotton-seed meal; linseed meal; gluten meal and feed; germ oil meal; corn bran; dried distillers' grains; malt sprouts; dried brewers' grains; hominy feeds; mixed wheat offals, i. e., mixed feeds; compounded, i. e., proprietary or commercial feeds; meat meals and similar goods; mixed poultry feeds; sugar beet by-products; barley feeds and meal; ground oat hulls; oat feeds; wheat breakfast food by-products; alfalfa meal; rye mixed feed; buckwheat middlings; rice feed; and miscellaneous mixed feeds.

Singed cacti as a forage, J. J. Thornber (*Arizona Sta. Bul. 51, pp. 546–549, figs. 2*).—Data regarding the importance of cacti as forage plants are reported, together with analyses noted from another publication (E. S. R., 16, p. 1003). The general conclusions follow:

"The real value of the stems of the cholla, prickly pear, and other cacti for forage is not fully determined. The consensus of opinion among feeders in Australia and Texas seems to be that prickly pear maintains life, but does not fatten animals. The subject is one properly to be investigated, especially in view of the interest in forage cacti current at the present time."

Animal breeding and feeding investigations, D. E. Salmon (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 77, pp. 527–538, pl. 1*).—Noted from another publication (E. S. R., 17, p. 169).

The effect of lecithin on proteid metabolism when taken with and without asparagin, W. Völtz (*Arch. Physiol. [Pflüger], 107 (1905), No. 7–9, pp. 415–425*).—The results of an extended series of experiments which were made with dogs are reported.

The author's principal conclusions follow: With the same individual under uniform diet and like conditions considerable variations occur in the nitrogen metabolism. The nitrogen metabolism was increased much more when casein and asparagin were fed together than was the case with albumin and asparagin. Replacing a part of the albumin nitrogen by an equal quantity of lecithin nitrogen affected the protein cleavage in the body favorably. Good results were also noted when lecithin and asparagin replaced part of the albumin nitrogen.

The oft-noted increase in protein metabolism when asparagin was fed with proteids containing phosphorus (paranuclein, casein, or brain tissue), as compared with the

increase when fed with albumin, is attributable to the influence of that portion of the proteid molecule which contains phosphorus, namely, paranucleic or nucleic acid.

The influence of different proteids and their derivatives upon nitrogen metabolism with special reference to the effect of asparagin, W. Völtz (*Arch. Physiol.* [*Pflüger*], *107* (*1905*), *No. 7–9, pp. 360–414*).—The experiments reported were made with dogs and led to a number of general conclusions from which the following are taken:

Paranuclein nitrogen is more completely absorbed than serum-albumin nitrogen, though somewhat more of the latter is retained. Asparagin is not fully assimilated, 4.6 to 12.9 per cent having been recovered in the feces. In all the experiments asparagin was found to be inferior to proteids for maintaining or increasing the body protein level. When asparagin was supplied with casein the proteid cleavage was very marked.

When asparagin and serum albumin were supplied together the cleavage of protein induced by asparagin was less marked than when it was fed with paranuclein or nuclein. Under same conditions asparagin fed with serum albumin led to gains in nitrogen.

The action of intestinal juice on enteric secretion, A. Frouin (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 15, pp. 702–704*).—From experimental evidence the conclusion was reached that the absorption of some constituents of intestinal juice acts as an excitant of secretion under physiological conditions.

Does pancreatic juice contain lactase? H. Bierry (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 15, pp. 701, 702*).—Experiments with dogs gave negative results, and confirmed Bainbridge's work.

The proper utilization of food stuffs, A. M. Soule (*Va. Dept. Agr. Ann. Rpt.*, *26* (*1904*), *pp. 61–71*).—A summary and discussion of data on the composition of feeds, feeding and care of farm animals, and related questions.

The assimilation of calcium and phosphorus from different phosphates by grown animals, A. Köhler et al. (*Landw. Vers. Stat.*, *61* (*1905*), *No. 5–6, pp. 451–479*).—The data here reported in full have been noted from a brief account previously published (E. S. R., 16, p. 1005).

Feeding steers on sugar-beet pulp, alfalfa hay, and ground corn, W. L. Carlyle and C. J. Griffith (*Colorado Sta. Bul. 102, pp. 12*).—Continuing earlier work (E. S. R., 17, p. 66), the feeding value of alfalfa hay alone and supplemented by beet pulp, ground corn, and these 2 feeding stuffs together was tested with 4 lots of 12 steers each.

Alfalfa hay and beet pulp were fed ad libitum and the corn in increasing amounts up to 11 lbs. per head per day. The average daily gain in the 14 weeks of the test was 2.7 lbs. per head on a ration containing both beet pulp and ground corn. On alfalfa hay and ground corn it was 1.8 lbs.; on beet pulp and alfalfa hay it was 1.9 lbs.; and on alfalfa hay only it was 1.5 lbs.

The cost of a pound of gain ranged from 4.22 cts. on the ration containing beet pulp and corn meal to 7.63 cts. on alfalfa hay and ground corn. The greatest profit, $12.70, was obtained with the beet pulp and ground corn ration and the smallest profit, $5.44 per lot, with the lot fed alfalfa hay only.

"An average 'feeder' steer 2 years old will make a gain of 1.5 lbs. per day on alfalfa hay alone, and will require approximately 28 lbs. of hay to make 1 lb. of gain. The addition of ground corn to the ration of alfalfa hay will increase the daily gain, increase the market price of the steer by finishing him better in a given time, and will add to the profits if the corn can be procured below 90 cts. per 100 lbs.

"A pound of ground corn is equal in feeding value to 2.8 lbs. of alfalfa hay and to 9 lbs. of sugar-beet pulp for feeding 2-year-old fattening steers. Sugar-beet pulp at present prices is a cheaper and better feed than ground corn when fed with alfalfa hay for fattening mature steers. [It appears] that 3.22 lbs. of beet pulp is equiva-

lent in feeding value to 1 lb. of alfalfa hay when fed in conjunction with the hay giving 2-year-old steers all they will eat of both feeds.

"With alfalfa hay at $5 a ton, it will pay to feed a light ration of ground corn with the hay, provided the corn can be purchased at from 85 to 90 cts. per 100 lbs. With poor alfalfa hay at $5 per ton, sugar-beet pulp is worth $1.50 per ton to combine with the hay for fattening mature steers.

"Fattening steers will gain approximately a pound a day more on a ration composed of alfalfa hay, ground corn, and beet pulp than they will on a ration made up of alfalfa hay and ground corn or on a ration composed of alfalfa hay and sugar-beet pulp, and they will gain almost 1.5 lbs. more each day on the above ration than when fed alfalfa hay alone."

Prolificacy with ewes and breeds of sheep, C. S. PLUMB (*Proc. Soc. Prom. Agr. Sci., 26 (1905), pp. 99–103*).—The value of breeding stock is in a large measure affected by productive capacity, and this subject is discussed with special relation to sheep.

As shown by figures extending over 9 years, gathered from the American Shropshire Association flock books, out of a total of 23,037 lambs 59.2 per cent were singles, 39.2 per cent were twins, and 1.3 per cent were triplets. "It is interesting to note that for a term of 9 years there seems to be no material change in the percentage of number of lambs at birth. Whether the Shropshire is becoming more or less prolific as a breed is open to question."

Data regarding 43 Rambouillet ewes, gathered by the author at the Indiana Experiment Station during a period of 4 years, showed that 41.8 per cent of the lambs were singles, 51.1 per cent twins, and 7 per cent triplets, a prolificacy somewhat greater than that noted with the Shropshires.

The principles and practice of horse breeding, A. S. ALEXANDER (*Wisconsin Sta. Bul. 127, pp. 128, figs. 72*).—Uniformity and persistency in breeding, objectionable qualities of grade sires, unreliability of crossbred sires, the value of pedigrees, the importance of generous feeding, and other questions connected with horse breeding are discussed, as well as training, hoofs, and shoeing, the prevention of navel and joint disease of foals, marketing horses, characteristics of different breeds, and similar questions.

The bulletin also contains a number of short articles by different writers on the care and management of horses and similar topics, as well as a list of American and foreign stud books and a summary of Wisconsin laws pertaining to horse breeding.

The feeding of molasses to work stock, W. H. DALRYMPLE (*La. Planter, 34 (1905), Nos. 19, pp. 302–304; 20, pp. 319–321, 323*).—On the basis of data gathered from a large number of Louisiana planters, the author states that molasses is widely used as a feeding stuff for plantation horses and mules, the average consumption on 42 plantations in the sugar belt being 9.5 lbs. per head per day, the range, according to the statistics gathered, being from 2 to a little over 21 lbs. The data collected confirm the opinion that molasses constitutes a wholesome and easily digested as well as economical constituent of a ration for draft animals.

In a discussion following the paper, additional data regarding the successful use of molasses as a feeding stuff are given, as well as some sample rations. The fact is also brought out that molasses is most successful as a feed when mixed with some absorbent material, such as ground unhusked corn.

The crate-fed chicken industry, F. C. HARE (*Rel. Poultry Jour., 11 (1904), Nos. 9, pp. 873–875; 10, pp. 975, 976, 1004, 1005; 11 (1905), Nos. 11, pp. 1143–1146; 12, Sup., pp. III, IV; 12 (1905), Nos. 1, Sup., pp. IV–VI; 2, pp. 223, 224; 3, pp. 397–399; 4, pp. 466, 467, figs. 20*).—The advantages which attend the crate feeding of poultry are pointed out, and the subject discussed with reference to profitably fattening chickens for market.

The experience of practical feeders in this method of fattening poultry is quoted, the system is explained in detail, and the construction of feeding crates and build-

ings for sheltering them, the comparative value of different feeds, the superior value of raw over cooked feeds, slaughtering, marketing, and dressing, and other topics are considered, and a number of test rations suggested. The problem of standard types for crate fattening is also taken up, and it is pointed out that the desirable characteristics are present in the American class of poultry.

Attention is directed to the fact that after dressing, chickens should be thoroughly cooled before packing, and the author considers it desirable to keep them for 10 to 24 hours at a temperature of 30 to 35°. A one-layer wooden shipping case is, in his opinion, the most desirable for shipping. The tray should be lined with parchment paper and the chickens neatly arranged.

Tests were made of the amounts of edible flesh on crate-fattened and other birds with 6 pairs of Barred Plymouth Rock cockerels each pair weighing on an average 7 lbs. 8 oz. Two birds were killed at the beginning of the test and weighed together, plucked but not drawn, 6 lbs. 8 oz. After cooking the edible flesh was removed and weighed 1 lb. 10 oz. The weight of the bones was 12 oz. and of the offal 2 lbs. 4 oz.

The author states that the chickens killed cost 16 cts. per pound, and calculates that the edible flesh cost 64 cts. per pound. The remaining 10 cockerels were fed in crates for three weeks, the average live weight at the end of this time being 12 lbs. per pair. Two cockerels were killed, their weight when plucked but not drawn being 10 lbs. 12 oz. The cooked edible meat weighed 5 lbs., the bones 18 oz., and the offal 4 lbs. 10 oz. The author assumes that the crate-fed birds cost 20 cts. per pound and calculates that the edible flesh, therefore, cost 42 cts. per pound. He calls attention to the fact that in addition to being cheaper the flesh of the crate-fed birds was markedly superior as regards flavor and quality.

Turkeys—from shell to market, J. C. Clipp (*Va. Dept. Agr. Ann. Rpt., 26 (1904), pp. 154-156*).—On the basis of experience the author discusses the feeding and care of turkeys. For young chicks he recommends sweet milk and raw eggs about twice a week, in the place of hard-boiled eggs and sour-milk curd. Millet and whole wheat are regarded as the most satisfactory grains for turkey chicks.

DAIRY FARMING—DAIRYING.

Influence of feeding sesame cake on the properties of butter fat, J. Denoël (*Rev. Gén. Lait, 4 (1905), Nos. 20, pp. 464-469; 21, pp. 490-496*).—In a test with 16 cows, 2.5 kg. of sesame cake, and at times ½ liter of sesame oil in addition, were fed each animal daily without the butter in any instance showing a red coloration upon the addition of hydrochloric acid and furfurol, not even when the temperature was raised from 60 to 70° C. It is believed that a red coloration reported by some observers as occurring with hydrochloric acid and furfurol alone was due to the use of impure furfurol or an old solution.

The author also reviews the results obtained by various investigators with the Baudoin reaction and discusses the different means which have been proposed for enabling the ready detection of margarin, such as the compulsory addition of sesame oil in the manufacture of margarin, concluding that none of them answers perfectly the end desired.

Feeding fat into milk (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 75, pp. 43*).—This is a reprint from the annual report of the Bureau of Animal Industry for 1902 of the two articles, Recent Experimental Inquiry upon Milk Secretion, by C. D. Woods (E. S. R., 15, p. 505), and The Physiology of Milk Secretion, by A. W. Bitting (E. S. R., 15, p. 523).

On the feeding value of distillery pulp for milch cows, N. Hansson (*Nord. Mejeri Tidn., 20 (1905), No. 23, pp. 308-311*).—A feeding experiment with 30 cows,

separated into 5 lots, was conducted by the author for the purpose of determining the comparative value of distillery pulp and beet pulp as feeds for milch cows.

The distillery pulp was obtained from ⅔ potatoes and ⅓ Indian corn. Chemical analysis showed it to vary considerably in composition, the water content of seven samples ranging between 91.67 and 95.80 per cent, and the protein content between 1.20 and 2.25 per cent. The average composition was as follows: Moisture, 93.79 per cent; fat, 0.33 per cent; crude protein, 1.62 per cent; carbohydrates, 3.65 per cent; ash, 0.61 per cent; acidity (calculated as lactic acid), 1.27 per cent.

The experiment was continued for 71 days, separated into 3 periods, of which the second was the experimental period proper of 30 days' duration. The results indicated that 14 kg. of distillery pulp fully took the place of 13 kg. of beet pulp. In a ration low in protein, 14 kg. of distillery pulp could not, however, take the place of 1 kg. mixed concentrated feed (sunflower-seed cakes, cotton-seed meal, and wheat bran, fed in the proportions of 0.4:0.4:2.5). This was, on the other hand, apparently the case when a ration rich in protein was fed.—F. W. WOLL.

Dairy herd record, W. J. ELLIOTT (*Montana Sta. Rpt. 1904, pp. 207-210*).—Records of 6 cows for 1 year are reported and comments made thereon.

The discussion of the milk problem from the standpoint of production, C. E. MARSHALL (*Michigan Sta. Bul. 228, pp. 185-195*).—Among the features of the problem considered are the cost of milk production, the ability of individual farmers to produce milk profitably under conditions fulfilling the requirements of the sanitarian, the unwillingness of consumers to pay extra prices for pure milk, the ignorance of consumers and even milk inspectors concerning milk production, the proper handling of milk, etc.

It is estimated that 12 cts. per quart is not too high a retail price for milk when all the conditions under which it is produced and handled are ideal. The author does not believe that 1 per cent of the farmers are capable of producing milk profitably in a pure form. He argues for the production and sale of milk of different grades on a business basis. Such specifications as seem fair for the production of 5-cent milk, 6-cent milk, and so on, should be agreed upon by contract between producer and consumer.

The producer should decide upon what grade of milk he is willing to produce. The consumer should understand clearly the difference between, say, 5-cent milk and 10-cent milk and should decide what grade he wants. The inspector specially trained for this purpose should merely see that the specifications are fulfilled. Forty-one specifications are enumerated, all of which it is believed should be embodied in a contract for the best grade of milk.

Scheme for the sanitary control of the municipal milk supply, G. W. GOLER (*Amer. Med., 10 (1905), No. 17, pp. 696-699, dgms. 3*).—A brief account is given of the establishment and development of the Gouttes de Lait, or infants' milk depots, which, it is argued, should now be aided and extended by the State instead of by private philanthropy.

The plan of municipal control presented provides for a chief sanitary officer and advisory board for the Gouttes de Lait, an advisory board or milk commission for the general milk supply, and a bureau for inspection and laboratory examination. With some modifications, this plan has been in operation in Rochester, N. Y., and some of the results there obtained are here presented. For several years the effort has been made to secure a municipal standing of 100,000 bacteria per cubic centimeter. The average number, however, during 1904 was 253,727. Of the total samples examined, 47 per cent contained less than 100,000 bacteria per cubic centimeter.

A study of the milk supply in New York, S. W. S. TOMS (*N. Y. State Jour. Med., 5 (1905), No. 9, pp. 336-344*).—The author discusses the subject of milk contamination, reports upon the condition of a number of dairies inspected by him, and gives the regulations and rules for the production and sale of milk in Rockland County.

The composition and analysis of milk, H. D. RICHMOND (*Analyst, 30 (1905), No. 355, pp. 325–329*).—The average composition of 15,910 samples of milk analyzed during 1904 was as follows:

Specific gravity, 1.0322; total solids, 12.68 per cent; fat, 3.74 per cent; and solids-not-fat, 8.94 per cent. The average fat content of the morning milk was 3.52 per cent and of the evening milk 3.96 per cent. The average fat content was 0.09 per cent lower than in 1903, as a cause of which it is suggested that on account of weather and soil conditions the fodder crops grown in 1904 were not of the same quality as in the years immediately preceding.

It was found that in burning a sample of milk 0.008 per cent of the chlorin was lost. Analyses are reported of human milk, and of buttermilk prepared by churning sweet cream, sour cream, and sour skim milk. A preparation advertised as a milk preservative and claimed to consist of nothing but constituents of milk was found to contain hydrogen peroxid, sodium chlorid, sodium phosphate, potassium carbonate, and another potassium salt not identified.

Owing to a want of agreement of authorities as to the correct volume of one division of the neck of the Gerber bottle, this and related questions were investigated. The conclusion was reached that 0.126 cc. was the best value for one scale division. The volume of fat obtained by the Gerber method was found to exceed that of the actual fat present, the mean ratio being 1.025. This increase is believed to be due to a change in the composition of the fat. The author estimates the volume of fat between the upper and lower layers of the meniscus as equal to 0.08 per cent, and believes that this amount, which is always neglected in reading, is partly compensated by the decrease of the weight of milk with increasing quantities of fat as delivered by an 11 cc. pipette. The exact diameter of the neck of the bottle is not believed to be of importance.

The analysis of samples of milk referred to the government laboratory in connection with the sale of food and drugs act, T. E. THORPE (*Analyst, 30 (1905), No. 351, pp. 197–205*).—The samples of milk in question are invariably sour and hence a study has been made to determine if this fact prevents a true inference being made as to the character of the fresh milk.

Of 13 samples of genuine milk kept for periods varying from 2 to 14½ weeks the decrease in fat content averaged only 0.06 per cent. These results were not affected by the addition of water. Souring, therefore, does not affect to any important extent the fat in milk.

The loss in solids-not-fat during the same time was 0.24 to 0.87 per cent for genuine milks and 0.23 to 0.68 for watered milks, due mainly to the production of alcohol and volatile acids. The total loss in solids varied as a rule from 0.2 to 0.5 per cent, and it is considered that a determination of solids within these limits is satisfactory from the standpoint of inspection.

Twenty gallons of milk was diluted with one-fourth its volume of water and kept in stoppered bottles at about 18° C. for 10 to 12 weeks. In this were found 76.4 gm. ethyl alcohol, about 390 gm. of normal butyric acid, 116 gm. acetic acid, nearly 2 gm. of an acid of higher molecular weight than butyric acid, ammonia, and traces of propionic acid. "Hence, therefore, it may be considered proved that by far the greatest portion of the volatile products of the fermentation of milk, other than water and carbon dioxid, are ethyl alcohol, acetic and butyric acids, and a small quantity of ammonia."

The methods of analysis employed in the laboratory are described.

The morphology of milk and colostrum secretion, J. ARNOLD (*Beitr. Path. Anat. u. Allg. Path., 38 (1905), No. 2, pp. 421–448, pl. 1*).—According to the histological studies of the author, the secretion of milk fat depends upon a transformation of the cytoplasm of the mammary epithelial cells which are not destroyed in the process. The first drops of fat appear in the basal portion of the cell and in the

region of the nucleus. Vacuoles appear later. The fat globules are expelled without injury to the cells. While mitosis and cell degeneration may occur synchronously with fat secretion, the latter is not dependent upon these two processes.

Nitrogenous substances are found in the large secreted bodies and also in the form of small and large drops in the cytoplasm of the cells and in the alveoli. Colostrum bodies are for the most part derived from leucocytes, in which process both phagocytosis and synthesis take part. Epithelial cells containing fat are, however, also found in the alveoli. The cap-like appendages of colostrum bodies are of different origin. A bibliography is appended.

Investigations of market milk in Leipsic with special reference to the presence of streptococci, H. BRÜNING (*Jahrb. Kinderheilk.*, *62* (*1905*), *No. 1*, *pp. 1–21*).—Forty samples of market milk were collected during the period from July to October, 1904, and examined.

Of the 26 samples of whole raw milk 7 were amphoteric in reaction and 19 alkaline. Five samples showed a fat content below 2.8 per cent, the legal standard in Leipsic. The average of the 26 samples was 3.12 per cent. Storch's reaction for detecting raw milk was positive except in one instance, in which case Schardinger's formalin-methylene blue reaction was also negative. The latter test was negative with goat's milk.

Streptococci were present in 93 per cent of the samples of raw milk, varying in number from 100 to 1,000,000 per cubic centimeter. The morphological and cultural characteristics of some of the different forms are briefly noted. In one instance the intraperitoneal injection of a mouse with an excessive dose of a bouillon culture of a streptococcus isolated from the milk proved fatal. Otherwise the streptococci isolated were nonpathogenic for mice and guinea pigs.

Extended studies of the associative action of bacteria in the souring of milk, C. E. MARSHALL (*Michigan Sta. Spec. Bul. 33*, *pp. 23*).—This is a continuation of investigations previously noted (E. S. R., 16, pp. 299 and 1014).

The history and characteristics are given of the germ designated B, which has been found to hasten the souring of milk when grown in association with lactic-acid bacteria as compared with the time required by the lactic-acid bacteria when grown in pure cultures. The author presents considerable data and discusses at some length the variations in milk in relation to bacterial development, concluding that this variation is at all times of sufficient importance to be borne in mind when milk is used for cultural purposes. The author has also found that litmus added to milk causes irregularity in cultures as compared with the same lot of milk without litmus.

The changes produced in milk by germ B, so far as ascertained, are described. In experiments in butter making, it was found necessary to add 45 per cent of a starter of the lactic-acid organism used in order to cover up the disagreeable odor and taste produced in butter by germ B. The importance of associative action in practical dairying is discussed and it is noted that experiments are now in progress to secure more knowledge upon this subject.

A popular review of Special Bulletin No. 33 on "The associative action of bacteria in the souring of milk," C. E. MARSHALL (*Michigan Sta. Bul. 229*, *pp. 196–201*).—See above.

The bacteria of pasteurized and unpasteurized milk under laboratory conditions, L. A. ROGERS (*U. S. Dept. Agr.*, *Bur. Anim. Indus. Bul. 73*, *pp. 32*).—The author reviews considerable literature on the subject of milk supplies of cities, showing thereby that milk is usually found to be badly contaminated by bacteria, and that while some authorities consider pasteurization an advisable remedy for this condition, others believe that the bacteria which develop in pasteurized milk make it more dangerous than raw milk.

He reports a series of experiments in which quantitative and qualitative comparisons were made of the bacterial flora of raw and pasteurized milk kept at different temperatures and also discusses the influence of lactic-acid bacteria on the development of peptonizing bacteria. No attempt was made to demonstrate the advisability or inadvisability of pasteurization.

The experimental work is summarized by the author as follows:

"Milk was pasteurized under laboratory conditions in a continuous machine at 85° C. (185° F.), the bacteria being reduced from over 10,000,000 per cubic centimeter to less than 500 per cubic centimeter.

"*Milk held at 20° C. (68° F.).*—In the unheated milk the lactic bacteria increased rapidly and the milk became acid in about 12 hours. The peptonizing bacteria increased in 6 hours to about 5,000,000 per cubic centimeter and then decreased slowly.

"In the heated milk the peptonizing bacteria increased rapidly after 12 hours, and the milk was usually curdled in 48 hours, with a disagreeable taste and odor. Occasionally lactic bacteria survived pasteurization and multiplied rapidly after 24 hours, completely inhibiting the peptonizing bacteria.

"*Milk held at 10° C. (50° F.).*—In unheated milk the growth of the bacteria and the consequent curdling of the milk was much retarded. The average milk did not contain sufficient acid to affect the taste until it was over 48 hours old. The proportion of peptonizing to lactic bacteria was greater than at the higher temperature, and the taste of the milk occasionally showed the influence of the former.

"In the pasteurized milk the bacteria increased very slowly, and in nearly every case the milk was unchanged in taste and appearance 96 hours after pasteurization. In only 2 of 14 cases was there a marked increase of peptonizing bacteria. The predominating bacteria were species having little or no effect on milk.

"The lactic bacteria inhibited the development of the peptonizing bacteria only when they had developed sufficient acid to render the milk unfit for use.

"It seems probable that the acid had a distinct inhibitory action on the proteolytic enzyms of the peptonizing bacteria."

The efficiency of commercial pasteurization and its relation to the milk problem, S. C. PRESCOTT (*Technol. Quart., 18 (1905), No. 3, pp. 247-256*).—Tables show the number of bacteria in milk before and after pasteurization.

In one series of 32 tests, 97.1 per cent of the bacteria were killed by exposure to a temperature approximating 164° F. The average efficiency of another machine in 34 tests was 96.1 per cent. In 10 tests where the bacterial content varied from 3,250,000 to 9,700,000 per cubic centimeter, the average efficiency of commercial pasteurization was 99.1 per cent.

The author believes that all pasteurized milk should be sold as such, and that there should be laws regulating the age, acidity, and bacterial content of milk which is to be pasteurized and subsequently offered for sale.

Raw milk as a food for infants, M. HOHLFELD (*Jahrb. Kinderheilk., 62 (1905), No. 1, pp. 22-34, figs. 4*).—The clinical evidence presented indicates that raw cows' milk is much better than boiled milk for feeding infants affected with gastric or intestinal catarrh.

Some creamery problems, E. H. FARRINGTON (*Wisconsin Sta. Bul. 129, pp. 26, figs. 4*).—(1) *Care of cream at the farm.*—It is stated that the usual causes of defective butter from gathered cream are keeping the cream in unsuitable places and holding it too long before delivery at the creamery. Suggestions are given for the proper care of cream at the farm. Causes of variations in tests of separator cream are stated and directions are given for sampling and testing cream.

(2) *Overrun from milk and cream.*—The factors upon which depends the amount of butter that may be made from a given quantity of milk or cream are the test of the milk or cream, the losses of fat in the skim milk and buttermilk, the water content

of the butter, and mechanical losses, each of which is discussed. Differences in overrun from milk and from cream are explained and illustrations of overrun calculations are given. Under ordinary conditions the overrun from milk ranges from 10 to 16 per cent and from cream from 16 to 20 per cent.

(3) *Calculating dividends for milk and for cream patrons at the same factory.*—In the method described and illustrated the number of pounds of fat delivered by the cream patron is increased by 3 per cent to offset the fat in the skim milk taken away by the milk patron.

(4) *Cleaning test bottles.*—An arrangement for cleaning a number of test bottles at the same time is described and illustrated. The bottles are placed in sockets in a frame and held in place by a perforated metal plate through which the necks of the bottles project. By means of this device a dozen bottles may be washed at the same time.

(5) *An alkaline tablet solution bottle.*—A graduated tube with a stopcock is connected with the side of a bottle in such a manner that it may be filled with the test solution merely by tipping the bottle.

Contribution to the knowledge of the variability of the constants of Holland butter, E. C. H. A. M. BEMELMANS (*Contribution à l'étude de la variabilité des constantes des beurres néerlandais. Bréda, 1905, pp. 81; rev. in Rev. Gén. Lait, 4 (1905), No. 22, pp. 521, 522*).—The literature of the subject is reviewed and determinations of the Reichert-Meissl, Köttstorfer, and Zeiss refractometer numbers of the butter from 485 cows are reported in the monograph.

The data show that the Reichert-Meissl number of pure Holland butter may not only exceptionally but does quite generally fall below 24. Considerable differences were observed between the constants of butter from cows stabled and cows pastured.

Some experimental results concerning the butter making process, J. SIEDEL (*Molk. Ztg., 19 (1905), Nos. 24, pp. 599, 600; 25, pp. 627-629; 26, pp. 658, 659*).—The changes taking place in cream during churning are discussed and some experiments reported.

A Swiss cheese trouble caused by a gas-forming yeast, H. L. RUSSELL and E. G. HASTINGS (*Wisconsin Sta. Bul. 128, pp. 26, figs. 10*).—The authors investigated an unusual fermentation occurring in Swiss cheese in a factory in Wisconsin.

Affected cheeses begin to crack open on the edges soon after taken from the press and acquire a sweetish flavor. The loss from this trouble amounted to over $2,000 in one factory. The cause of the trouble was found to be a yeast which was able to ferment milk sugar, the characteristics of which are reported. Certain methods followed in Swiss cheese factories were found to aid in the development of the yeast organism. These are (1) the custom of holding the whey until sour in order to recover the butter fat for whey butter, (2) the use of whole rennets soaked in sour whey, and (3) the barrel method of whey disposal.

In making suggestions for avoiding this abnormal fermentation the immediate separation of the whey in a cream separator, the use of commercial rennet extracts or the soaking of whole rennets in sterilized whey, and greater care and promptness in the disposal of the whey are recommended. A German translation of this article is appended.

Report of the dairy commission on the inquiry made in 1904 concerning the influence of different factors upon the successful management of Emmenthal cheese factories with special reference to artificial fertilizers and feeding stuffs (*Landw. Jahrb. Schweiz, 19 (1905), No. 5, pp. 251-293*).—A study was made of 36 cheese factories in Switzerland the results of which throw light upon the influence of various factors upon the successful and profitable manufacture of cheese in that country, and also serve as a basis for directions which are given concerning the use of fertilizers and feeding stuffs where milk is produced for Emmenthal cheese making.

Cheese experiments at Tann säter, Ringebu, Norway, 1904, O. IVERSEN (*Tidsskr. Norske Landbr., 12 (1905), No. 2, pp. 68-77*).—This contains a report of experiments on the manufacture of goat cheese (gjedmyseost) at a Norwegian mountain dairy, and a contribution to the question of the consolidation of mountain dairies.—F. W. WOLL.

Danish creamery statistics, 1904, J. N. DALL (*Odense, 1905, pp. 186*).—This report is published with government aid by the Bureau of Creamery Statistics. It gives detailed statistics for 524 Danish creameries and contains a large amount of information on the conditions under which each creamery is operating. Analyses of skim milk and buttermilk and statistics in regard to the manufacture of cheese are also given.

A report on the operation of the Danish pasteurization law completes the volume. This report shows that 1,267 Danish creameries were under government control under the law of March 26, 1898, establishing measures for the eradication of bovine tuberculosis. Of these creameries 1,105 are cooperative creameries, 133 proprietary, and 29 estate dairies.—F. W. WOLL.

Dairy control associations in Norway, 1903-4, L. I. FUNDER (*Aarsber. Offentl. Foranst. Landbr. Fremme, 1904, pt. 1, pp. 489-569*).—The first dairy control associations were established in Norway in 1899. They were patterned after the corresponding Danish institutions.

The number of associations in 1903-4 was 145, 26,671 cows being included. The cows are tested regularly at intervals ranging from 13 to 30 days and averaging 19 days for the different associations. Detailed data for all the associations are given in this report. The government contributed about \$6,300 annually to the expenses of the associations, the balance being paid by the farmers whose herds were tested.—F. W. WOLL.

Report of Swedish butter exhibits, 1904, N. ENGSTRÖM (*Land, 1905, pp. 87*).—The report contains the usual information as regards the butter exhibits conducted during the year. The results of determinations of the fat contents of samples of skim milk from Swedish creameries, the refractive indexes of the butter, and its contents of volatile fatty acids are also presented in the report.—F. W. WOLL.

VETERINARY MEDICINE.

Report of proceedings of eighth annual meeting of the Interstate Association of Live Stock Sanitary Boards (*Proc. Interstate Assoc. Live Stock Sanit. Bds., 8 (1904), pp. 110*).—At the eighth annual session of this association held in St. Louis, August 23 and 24, 1904, several papers were read and discussions held which are of interest from the standpoint of animal production and veterinary science.

The objects pursued by the association were outlined by D. F. Luckey in an address of welcome, and the importance of the work of live stock sanitary boards was considered in the president's address, by J. C. Norton. In this address attention was called to work on Texas fever, tuberculosis, rabies, glanders, anthrax, etc. A paper on the control of certain communicable diseases among domestic animals was read by A. Peters, particular attention being given to the work of the Bureau of Animal Industry and State veterinarians in combating foot-and-mouth disease, Texas fever, and tuberculosis.

L. A. Klein discussed the subject of crude petroleum as a cattle dip for the destruction of ticks. Cattle dipped in Beaumont oil did not suffer any permanent injury; a few became stiff and lost appetite for a day or two. The effects upon the ticks were more satisfactory when the hair of the cattle was long in the fall and when the vitality of the ticks was less pronounced. The chief objection to dipping in oil appears to be the long period during which the cattle must be held after dipping. It appears, however, that the average cost of dipping and of feeding and caring for

cattle while they are detained averages 75 cts. per head. Papers were also read on inspection of cattle for breeding and dairy purposes, by F. T. Eisenman, and quarantine conditions in Oklahoma, by T. Morris.

Extracts from the annual report of the principal veterinary surgeon, S. STOCKMAN (*Transvaal Agr. Jour., 3 (1905), No. 10, pp. 244–254*).—In this report particular attention is given to a discussion of African coast fever and rinderpest.

African coast fever or Rhodesian redwater greatly retards the development of animal industry in South Africa, on account of the serious direct losses which it causes in the cattle and on account of the quarantine regulations which must be made against infected districts in order to prevent the further spread of the disease. The methods of treatment and vaccination which have been proposed by Koch and others have proved unsatisfactory in practice. A conference of veterinarians of South Africa adopted resolutions recommending that all cattle in infected and uninfected farms be slaughtered for meat, and that no cattle be raised on such farms until after the lapse of a period of 18 months.

The suggestion has been made that cattle be removed to high range land. Such a procedure, however, is of somewhat doubtful propriety on account of the likelihood of the extension of the areas of infection. The ticks which carry the disease may be destroyed to a considerable extent by burning the grass. Since 1903, 14 outbreaks of rinderpest have been dealt with. In the control of rinderpest the author believes that the use of virulent blood is a source of considerable danger. As the best means for stamping out the disease, the liberal use of serum is suggested, or the thorough application of bile inoculation.

Pathogenic micro-organisms including bacteria and protozoa, W. H. PARK and ANNA W. WILLIAMS (*New York and Philadelphia: Lea Bros. & Co., 1905, pp. VIII+556, pls. 4, figs. 165*).—In the present edition of this work the authors have sought to include the latest information on all subjects discussed, so as to render the volume authoritative for the use of students. Bacteria and protozoa are considered as related subjects, since both classes of organisms may produce diseases of somewhat similar symptoms.

The subjects discussed in the volume include general characteristics and classification of bacteria, technique of bacterial culture, disinfection and sterilization, effect of chemicals and other influences upon bacteria, the use of laboratory animals for diagnostic purposes, agglutination, immunity, and related topics, in addition to specific accounts of various pathogenic bacteria. The discussion of protozoa includes the classification of these organisms and special accounts of trypanosomes and other related organisms.

Pathogenic anaerobes and gangrenous suppuration, E. RIST (*Bul. Inst. Pasteur, 3 (1905), Nos. 1, pp. 1–8; 2, pp. 49–57; 3, pp. 97–104*).—A detailed account is given of the biology and pathogenic properties of blackleg and tetanus bacilli, micrococci, and other organisms in their relation to gangrenous suppurations. A brief bibliography of the subject is appended to the article.

Notes on parasitology and technique, B. GALLI-VALERIO (*Centbl. Bakt. [etc.], 1. Abt., Orig., 39 (1905), No. 3, pp. 230–247, figs. 3*).—Brief notes are presented on the appearance, behavior, and stainability of tubercle bacilli of various origin, blastomyces, trypanosomes, actinomyces, and *Uncinaria duodenalis*.

Results of investigations in the field of general pathology and pathological anatomy, O. LUBARSCH and R. OSTERTAG (*Ergeb. Allg. Path. Mensch. u. Tiere, 9 (1903), pt. 2, pp. 767, pls. 13, figs. 25*).—An elaborate review is presented by various specialists of literature relating to technique in the study of pathological anatomy, general textbooks, general etiology, and general pathology of the more important diseases affecting man and animals. A thorough subject index as well as an author index is appended to the volume.

Immunity reactions within generic groups, L. Zupink (*Ztschr. Hyg. u. Infectionskrank.*, *49* (*1905*), *No. 3, pp. 447–540*).—The author conducted an extended series of experiments for the purpose of determining, so far as possible, the relationship between bacteria by means of the phenomena of immunity.

As a result of this study the conclusion is reached that a more natural system of classification of bacteria is necessary. It is believed that the number of species at present recognized is altogether too great, and that the generic groups recognized by most authors do not properly indicate the relationship between different bacteria. The suggestion is made that a better system of classification may be devised on the basis of the etiological connection of bacteria with animal and human diseases.

It has been shown that there are several diseases which may be produced by bacteria belonging to different species but to the same genus. All immunity reactions known at present take place within generic groups rather than that of the species. Among the different pathogenic bacteria belonging to a single generic group there are often species which produce similar diseases in the different animals, but are of quite different virulence. This fact makes it possible to devise a rational and successful system of treatment, according to which serum therapy may be utilized as based on the action of species of bacteria which are harmless for the animal in question and closely related to other species which produce serious disease.

Active and passive immunization of new-born and sucking animals through the medium of the intestines, E. Bertarelli (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig.*, *39* (*1905*), *No. 3, pp. 285–303*).—The literature relating to this subject is critically discussed.

During the author's studies, which were carried on chiefly with dogs and rabbits, age was found to be a very important factor in the successful immunization through the alimentary tract. It appears not to be a matter of indifference whether the animals are 2 or 20 days old. The processes which are possible at the former age may not be possible at the latter. Detailed accounts are presented of the numerous experiments carried out by the author. It appears that the hemolytic complement is not formed in dogs and rabbits until about the fourth or fifth day. The power of forming this body under the influence of bacteria in the intestines undergoes no striking change after the age of 15 to 20 days is reached.

In all experiments carried out by the author, passive immunization through the alimentary tract was accomplished with considerable difficulty, although absorption of the agglutinins took place quite readily in new-born animals. Nevertheless it appears that the absorption of protective bodies is much more active in young than in grown animals, and the author believes it possible to bring about a passive immunization of young animals by feeding on milk of actively immune animals.

Recent work on the bacteria of the group of tubercle bacilli, Kutscher (*Berlin. Klin. Wchnschr.*, *42* (*1905*), *No. 9, pp. 238–242*).—A brief review is presented of the recent work of von Behring, Römer, Koch, Friedmann, and others in determining the relationship between tubercle bacilli of different origin and in devising systems for vaccination against this disease.

Tuberculosis, Lottermoser (*Ztschr. Veterinärk.*, *17* (*1905*), *No. 3, pp. 109, 110*).—The author presents a brief account of a case of tuberculosis in a 4-year-old cow in which the lungs, liver, mesentery, and serous membranes were affected together with the right eye. A second case of tuberculosis reported by the author was found in the fetus of a cow which was affected with tuberculosis of the bones and other organs.

Primary tuberculosis of the mammary gland, G. D'Alessandro (*Clin. Vet.* [*Milan*], *28* (*1905*), *No. 8, pp. 37–41*).—A general discussion of the mammary form of tuberculosis is presented, with notes on a case in a cow which was observed by the author. In this case the pathological lesions were confined to the udder and apparently were of a primary nature.

The virulence of apparently intact mammary glands from tuberculous cows, H. MARTEL and G. GUÉRIN (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 2, pp. 153–158*).—A careful study was made of mammary glands from tuberculous cattle for the purpose of determining the presence or absence of tubercle bacilli in these structures.

During the investigations carried on by the authors the mammary glands taken for study showed quite varying conditions. In some cases lesions were present which did not appear to be tuberculous, in others the gland was affected with a streptococcic mammitis; and in still other cases the mammary glands were not affected but the adjacent lymphatic glands showed tubercles. In a few cases neither the mammary glands nor the lymphatic glands showed visible lesions. Material was taken from all of these glands and used in inoculation experiments.

The results obtained show conclusively that the mammary gland of tuberculous cattle may be infectious at any stage of the disease. The importance of this conclusion can not be easily exaggerated since it is thus apparent that the milk of all tuberculous cattle should be excluded from use in order to prevent the distribution of tuberculosis by this means.

The transmission of tuberculosis through the medium of milk and its prevention, C. W. STRANGE (*Iowa Agr., 6 (1905), No. 2, pp. 53–56*).—The possibility of transmission of tuberculosis through the agency of milk is briefly discussed and notes are given on the conditions under which tubercle bacilli may be present in milk.

Milk from tuberculous cows, G. MOUSSU (*Compt. Rend. Soc. Biol. [Paris], 58 (1905), No. 7, pp. 310–312*).—A careful test of the virulence of the milk of tuberculous cows was carried out on 5 calves, 2 of which became tuberculous after being fed on the tuberculous milk; the other 3 did not react to tuberculin and showed no tuberculous lesions although fed for 5 to 6 months on tuberculous milk. The author considers that his experiments indicate clearly the danger of using the milk of tuberculous cows.

Tuberculosis of the elbow joint in cattle, E. WYSSMANN (*Wchnschr. Tierheilk. u. Viehzucht, 49 (1905), No. 8, pp. 113–115*).—A recent study has shown that the tuberculous infection of the elbow joint in cattle is of comparatively frequent occurrence. Brief notes are given on the lesions observed in such cases and on the relation between tuberculosis of the joints and infection by this disease of other parts and organs.

A variety of zoogleic tuberculosis and its relation to pseudoglanders, J. CAGNETTO (*Ann. Inst. Pasteur, 19 (1905), No. 7, pp. 449–476, pl. 1, figs. 3*).—The literature relating to various forms of pseudotuberculosis is critically discussed in connection with bibliographical references.

The author made a study of a form of zoogleic tuberculosis, which closely resembles the usual type of pseudoglanders. The organism obtained from these cases produced orchitis or vaginitis when inoculated into guinea pigs. The disease appeared among laboratory guinea pigs which otherwise appeared healthy and showed no signs of disease until shortly before death. Upon post-mortem examination, numerous purulent nodules of varying size were found in the liver, spleen, various portions of the serous membranes, and on the wall of the intestines. The nodules were quite rare in the lungs. The contents of the nodules were of a bluish-white color and almost fluid consistency.

A detailed discussion is presented of the behavior of the organism obtained from these nodules when grown in various artificial media. The organism was found to be virulent for the guinea pig, pigeon, and white mice, while the rabbit, chicken, cat, and dog were strongly resistant to ordinary doses. The author discusses the relationship between this organism and other related organisms which cause other forms of pseudotuberculosis. Apparently, it belongs to the group *Pseudotuberculosis*

rodentium. The author proposes the name *Bacterium pseudotuberculare orchitophlogogenes* for the organism in question.

The vaccination of calves against tuberculosis, G. MULLIE (*Jour. Soc. Cent. Agr. Belg., 52* (*1905*), *No. 3, pp. 79–83*).—The methods previously adopted in controlling tuberculosis are outlined in some detail, particular attention being devoted to the extensive application of tuberculin and the isolation of reacting animals. A description is given of the method of vaccination proposed by von Behring. This operation does not involve any serious consequences in the cases of young animals, but in older animals some fever is produced together with a cough and other respiratory disturbances.

Vaccination of cattle against tuberculosis, H. VALLÉE (*Rev. Soc. Sci. Hyg. Aliment., 2* (*1905*), *No. 2. pp. 158–162*).—The system proposed by von Behring is outlined by the author, with notes on the work of other investigators along the same line and with similar methods.

In order to test the practicability of von Behring's method 25 cattle have been vaccinated by the author under the auspices of the Société de Médecine Vétérinaire Pratique, and these animals have since been inoculated with virulent tubercle bacilli of bovine origin. The cattle used in this experiment must be kept under observation for some time before the ultimate results of the experiment can be safely announced.

The diagnostic value of tuberculin, S. ARLOING (*Bul. Agr. Algérie et Tunisie, 11* (*1905*), *No. 4, pp. 81–84*).—According to the author's experience the cases in which tuberculin leads to false results, either in a negative or positive manner, do not exceed 3 to 5 per cent. The use of tuberculin is strongly recommended.

The tuberculin test for Missouri cattle (*Mo. Bd. Agr. Mo. Bul., 5* (*1905*), *No. 3, pp. 23, figs. 10*).—The announcement is made that so far as available veterinary funds will permit, the State board of agriculture proposes to make tuberculin tests on breeding and dairy cattle in Missouri without expense to the owners.

The percentage of tuberculosis among cattle in Missouri is not especially high, but the present measures are considered necessary in order to prevent the excessive spread of the disease among cattle. For the information of dairymen and stock raisers, notes are given on the symptoms of tuberculosis, the nature of tuberculin, reliability of the tuberculin test, and the general condition of the Missouri herds with regard to the prevalence of tuberculosis.

Parasitic bronchitis in calves, BERGEON (*Jour. Méd. Vét. et Zootech., 56* (*1905*) *Feb., pp. 91–94*).—An outbreak of this disease was studied by the author in 1903, in a herd of cattle in which there were 16 calves varying in age from 3 to 18 months.

Among this number 4 were in poor general condition, with symptoms of respiratory trouble. Some of the calves died of asphyxia or pulmonary hemorrhage. The postmortem examination of these animals disclosed the presence of *Strongylus micrurus* in the bronchi and bronchioles, the walls of which had been bored full of holes by the parasitic worms.

In controlling this disease the author recommends the isolation of diseased animals and careful attention in securing clean uninfested food and water supply. Some success was had in treating the disease by means of tracheal injections of a mixture containing 20 gm. of creosote in 100 gm. of oil of sweet almonds.

Stiffsickness, F. HUTCHINSON (*Natal Agr. Jour. and Min. Rec., 8* (*1905*), *No. 6, pp. 565–570, pl. 1*).—This disease, which appears among cattle in certain portions of Natal, appears to be confined to localities in which the soil is materially deficient in lime.

When animals are confined in such localities the disease becomes much more serious than when they are allowed to graze at will. Stiffsickness rarely assumes an acute form. Usually the symptoms develop gradually and consist in increasing stiff-

ness, involving finally the spinal column and resulting in paralysis of the hind quarters. The treatment is largely preventive and consists in furnishing suitable quantities of food containing a proper proportion of lime and other mineral constituents.

Anthrax, H. MARSHALL (*Ann. Rpts. Bd. Agr. Del., n. ser., 3-4 (1903-4), pp. 63-68*).—The various forms of anthrax are considered, together with an account of the distribution of the disease in Delaware and the factors concerned in its spread.

Immunizing of northern cattle against Texas fever, R. J. FOSTER (*Industrialist, 31 (1905), No. 27, pp. 419-423*).—The economic importance of the present method of immunizing cattle against Texas fever is discussed. Recommendations were made regarding the age at which cattle should preferably be inoculated, the time of year and place for such inoculation, together with notes on the treatment of the animals during the inoculation fever.

Preliminary note on a protozoan occurring in the eggs, larvæ, nymphs, and adults of ticks, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 76, pp. 2*).—An ameboid organism was studied which occurs in cattle ticks and passes from one generation to the next through the eggs. The organism in question occurs in both infectious and noninfectious ticks and can not, therefore, be a stage in the life history of the Texas-fever parasite. The organism is described as new under the name *Chaos acarophila*.

Dipping for cattle and sheep, F. W. WHITE (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 9, pp. 876-880*).—The relative value of dipping and spraying is briefly commented upon. Dipping is considered preferable and brief notes are given on methods of practical dipping for sheep and cattle on stock farms.

A note on the history of trypanosomiasis in English Sudan, A. LAVERAN (*Compt. Rend. Soc. Biol. [Paris], 58 (1905), No. 7, pp. 292-294*).—A brief description is given of the trypanosomes which have been found in domesticated animals in Abyssinia and Sudan in connection with a historical account of diseases caused by these organisms.

Trypanosoma dimorphon in French Guinea, CAZALBOU (*Compt. Rend. Soc. Biol. [Paris], 58 (1905), No. 9, pp. 395, 396*) —This parasite was found in the blood of horses affected with trypanosomiasis in French Guinea. Brief notes are given on the symptoms of the disease.

Morphological and experimental studies of Trypanosoma paddæ, THIROUX (*Ann. Inst. Pasteur, 19 (1905), No. 2, pp. 65-82, pl. 1, figs. 15*).—This trypanosome which was found in the blood of *Padda oryzivora* is described in detail, and notes are given on agglutination phenomena observed in reference to this organism and on its behavior when cultivated in various nutrient media. Inoculation experiments were undertaken with a number of other birds in addition to the rice padda, many of which proved to be susceptible. Rats, mice, and frogs were refractory.

The treatment of trypanosomiasis by arsenious acid and trypanroth, A. LAVERAN (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 5, pp. 287-291*).—The author continues an account of his experiments in treating trypanosomiasis in rats, mice, and other small rodents by means of arsenious acid and trypanroth.

It was found possible by means of this treatment to cure or prevent the disease in these animals. Each treatment consisted of an injection of 0.1 mg. for each 20 gm. weight of the animal, followed 48 hours later by twice that quantity of trypanroth. The animals subjected to this treatment lost weight temporarily, the skin became red, but no serious trouble was incurred.

Infectious anemia of horses, E. THIERRY (*Jour. Agr. Prat., n. ser., 9 (1905), No. 5, pp. 149-151*).—This disease appears under acute, subacute, and chronic forms. It is apparently due to an organism of ultramicroscopic size. A similar disease has been noticed in sheep.

Infectious anemia of the horse, CARRÉ and H. VALLÉE (*Bul. Mens. Off. Renseig. Agr. [Paris], 4 (1905), No. 9, pp. 1075-1077*).—The symptoms and forms of this

disease are briefly considered with notes on suitable methods of controlling the disease. It is recommended that infected animals be immediately isolated or slaughtered and the premises thoroughly disinfected.

An epizootic inflammation of the pharnyx in horses, KÜTHE (*Berlin. Tierärztl. Wchnschr., 1905, No. 10, pp. 185, 186*).—This disease occasionally breaks out in extensive epizootics and the author had occasion to observe a number of cases in artillery horses.

The appetite remains fairly good and there is little change in the rate of pulse and respiration. A slight elevation of temperature is usually observed. The incubation period is 7 or 8 days on an average. The disease appears to affect only mature or old horses. The lymph glands become somewhat infiltrated and in some cases develop abscesses. It appears to be somewhat uncertain whether this infectious form of pharyngitis is a distinct disease or a mixed infection.

Glanders and farcy, R. S. HUIDEKOPER (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 78, pp. 12*).—This is a revision by L. Pearson of an article in the Special Report on the Diseases of the Horse (E. S. R., 15, p. 620).

Glanders and farcy, E. THIERRY (*Jour. Agr. Prat., n. ser., 9 (1905), No. 9, pp. 284, 285*).—The author's opinion regarding the value of mallein in the detection of glanders is that this agent furnishes an absolutely certain means of diagnosing the disease. Mallein, however, does not serve to protect animals against the development of glanders.

Glanders, J. S. POLLARD (*Ann. Rpt. Bd. Agr. R. I., 20 (1904), pp. 110–113*).—The percentage of glanders among horses is said to be considerably on the increase. Attention is, therefore, called to the dangers of infection from this disèase in order to stimulate efforts for controlling it. Since treatment of glanders is not permissible in Rhode Island, it is desirable that the owners of all glanderous horses may notify the officials at once so that they may be destroyed according to law and prevent unnecessary infection with the disease.

Diseases of the nasal cavity resembling glanders, N. I. PETROPAVLOVSKI (*Arch. Vet. Nauk [St. Petersb.], 35 (1905), No. 6, pp. 441–447*).—A short account is presented of inflammatory diseases of the nasal cavity accompanied with nasal discharges and resembling glanders.

Swine plague, MARTENSEN (*Berlin. Tierärztl. Wchnschr., 1905, No. 10, pp. 188, 189*).—A description is given of the symptoms of intestinal catarrh of hogs referred to by Grips, Glage, and Nieberle as swine plague.

According to the author's experience the polyvalent serum recommended by these authors is quite inactive when used against true swine plague. In the author's opinion it is doubtful whether true swine plague assumes a chronic form resembling catarrh. The quarantine measures recommended by Grips and his associates in the control of swine plague are considered as unnecessarily severe.

Notes on swine plague, BUNGE (*Berlin. Tierärztl. Wchnschr., 1905, No. 9, pp. 164, 165*).—An outbreak of this disease occurred among a herd of 26 hogs. For the purpose of preventing the further spread of the disease the author inoculated 13 hogs with hog cholera serum in doses varying from 10 to 20 cc. Some of the animals were subsequently vaccinated with a mixture of hog cholera serum and polyvalent swine plague serum. After this vaccination no further cases of the disease appeared in the herd.

The control of swine plague, LOTHES (*Berlin. Tierärztl. Wchnschr., 1905, No. 6, pp. 101–105*).—The author argues in favor of the strict enforcement of the requirements for notification of the existence of this disease and of the application of suitable antiseptic and sanitary measures. Certain authors suggested a relaxation of the requirements in this regard, but it is believed that no advantage can be secured by such a procedure either to the hog raisers or to the veterinary authorities.

Some diseases of poultry, HÜNEBERG (*Transvaal Agr. Jour., 3 (1905), No. 10, pp. 227-231*).—While fowl cholera is considered incurable the vaccination of fowls against this disease is strongly recommended. In one instance 300 fowls were vaccinated and rendered immune while only 2 cases of cholera developed among the whole flock. The symptoms and post-mortem lesions of the disease are described in considerable detail. Notes are also given on diarrhea, tuberculosis, pip, and liver diseases.

Diseases and parasites of poultry, F. C. ELFORD (*Canada Dept. Agr., Poultry Div. Bul. 9, 1905, pp. 15*).—The prominent diseases of poultry are classified according to their nature and cause. The author gives a description with notes on the symptoms and treatment of gapes, rheumatism, intestinal troubles, limber neck, egg eating, roup, cholera, blackhead, and infestation by various species of lice, mites, and intestinal worms.

RURAL ENGINEERING.

The science of irrigation, C. S. MONCRIEFF (*Nature (London), 72 (1905), No. 1871, pp. 465-471*).—This presidential address before the engineering section of the British Association is a review of the growth and development of irrigation in Italy, Egypt, India, and America, and has been noted editorially (E. S. R., 17, pp. 105-108).

Irrigation and drainage investigations in Montana, J. S. BAKER (*Montana Sta. Rpt. 1904, pp. 249-275, pls. 6*).—A brief account of work carried on by the Montana Station in cooperation with this Department in duty of water experiments and drainage investigations, and including discharge tables of the principal rivers of the State.

Report of progress of stream measurements for the calendar year 1904 (*U. S. Geol. Survey, Water Supply and Irrig. Papers Nos. 124-135*).—"The chief feature of the work is the systematic study of the flow of the surface waters and the conditions affecting the same. . . . The general plan of stream gauging which has been developed is to obtain eventually data in regard to the flow of all the important streams in the United States.

"These papers contain the data that have been collected at the regular gauging stations, the results of the computations based upon the observations and such other information that has been collected that has a direct bearing on these data, including, as far as practicable, descriptions of the drainage areas and the streams draining them."

The following is a list of the different parts in which this work has been reported:

Pt. 1, Atlantic Coast of New England drainages, J. C. Hoyt (No. 124, pp. 157, pls. 2, fig. 1); pt. 2, Hudson, Passaic, Raritan, and Delaware River drainages, R. E. Horton, N. C. Grover, and J. C. Hoyt (No. 125, pp. 114, pls. 2, fig. 1); pt. 3, Susquehanna, Patapsco, James, Roanoke, Cape Fear, and Yadkin River drainages, N. C. Grover and J. C. Hoyt (No. 126, pp. 125, pls. 2, fig. 1); pt. 4, Santee, Savannah, Ogeechee, and Altamaha rivers and Eastern Gulf of Mexico drainages, M. R. Hall and J. C. Hoyt (No. 127, pp. 192, pls. 2, fig. 1); pt. 5, Eastern Mississippi River drainage, M. R. Hall, E. Johnson, jr., and J. C. Hoyt (No. 128, pp. 168, pls. 2, fig. 1); pt. 6, Great Lakes and St. Lawrence River drainage, R. E. Horton, E. Johnson, jr., and J. C. Hoyt (No. 129, pp. 150, pls. 2, fig. 1); pt. 7, Hudson Bay, Minnesota, Wapsipincon, Iowa, Des Moines, and Missouri River drainages, C. C. Babb and J. C. Hoyt (No. 130, pp. 204, pls. 2, fig. 1); pt. 8, Platte, Kansas, Meramec, Arkansas, and Red River drainages, M. C. Hinderlinder and J. C. Hoyt (No. 131, pp. 203, pls. 2, fig. 1); pt. 9, Western Gulf of Mexico and Rio Grande drainages, T. U. Taylor and J. C. Hoyt (No. 132, pp. 133, pls. 2, fig. 1); pt. 10, Colorado River and the Great Basin drainage, M. C. Hinderlinder, G. L. Swendsen, and A. E. Chandler (No. 133,

pp. 384, pls. 2, fig. 1); pt. 11, The Great Basin and Pacific Ocean drainage in California, W. B. Clapp (No. 134, pp. 276, pls. 2, fig. 1); pt. 12, Columbia River and Puget Sound drainage, D. W. Ross, J. T. Whistler, and T. A. Noble (No. 135, pp. 300, pls. 2, fig. 1).

Movable dam and lock of the Rice Irrigation and Improvement Association, Mermentau River, La. (*Engin. News, 54 (1905), No. 13, pp. 321, 322, figs. 5*).—A history and description of a dam used for shutting out the salt water of the Gulf of Mexico during the period when the irrigation pumping plants take more water from the river than is furnished by its natural flow, thus lowering the level of the water in the river below the Gulf level.

Compound centrifugal pumps, W. FRECHEVILLE (*Engin. and Min. Jour., 80 (1905), No. 18, p. 832*).—This article deals chiefly with an account of a plant for lifting 1,000 gals. per minute from a depth of 1,450 ft. in a mine in Spain. Four quadruple centrifugal pumps in series are driven by three phase motors. The pumps have worn well and are guaranteed to have an efficiency of 68 per cent. The surface steam plant and pumps have a combined efficiency of about 50 per cent, producing a water-horsepower hour on 4.8 lbs. coal.

The value of windmills in India, A. CHATTERTON (*Madras, 1903, pp. 3-15, dgms. 2*).—An experimental equipment was erected at Madras consisting of a 16-ft. windmill of American manufacture on a 70-ft. tower, attached to an 8-in. pump with a stroke of 16 in., and connected to suitable measuring tanks.

The 70-ft. tower raised the mill "well above the influence of obstruction to the wind caused by buildings and trees, and the whole country for miles around is a practically dead level plain." The mill was geared back 3½ to 1. Many careful measurements showed the discharge of the pump to be 86 per cent of the theoretical discharge. A tachometer was attached to the windmill for counting its strokes and was read three times daily. The lift of the pump was maintained at exactly 25 ft. The mill and pump were in continuous operation for more than a year. Hourly readings of the wind movement were obtained from the observatory about a mile distant from the mill.

From a comparison of all the observations it was found that they were very satisfactorily represented by the following equation: $X=210\ (y-53)$, in which "x" is the number of United States legal gallons lifted 25 ft. per twenty-four-hour day; and "y" is the total daily wind movement in miles.

"Careful observations on several days with an anemometer fixed to the windmill tower showed that it required a steady breeze of about 7.5 miles per hour to keep the windmill in continuous motion, but that, when the wind velocity exceeded 3 miles per hour, a certain amount of work was done as the result of puffs of wind."

Selecting a considerable number of intervals during which the wind blew with an almost constant hourly velocity greater than 8 miles per hour, it was found that these results were represented with great accuracy by the equation $x = 188\ y$, in which the letters represent the same quantities as before. This equation is based upon the results of some twenty-three different four-hour periods, the minimum wind velocity being 8 and the maximum about 15 miles per hour.

"When the daily wind velocity is below 53 miles per day, the amount of work done by the windmill is negligible, but above that velocity it steadily increased in direct proportion to the increased rate of the movement of the wind. This result is one of extreme importance, because makers of windmills invariably claim that the work done by a windmill is proportional to the cube of the wind velocity; and in their catalogues and price lists they publish fictitious tables showing the work done by the wind at various velocities."

After a discussion of the monthly wind movement, rainfall, and irrigation requirements, the author reaches the conclusion that a 16-ft. mill "will do sufficient work

in Madras to irrigate 10 acres of land planted to almost any crop when the water has to be lifted 25 ft."

The author quotes the results of Perry's experiments on windmills, carried out in this country, and says:

"These results can be very approximately expressed in the following way: The maximum work which can be done by a windmill in a 10-mile breeze is equal to one foot-pound per second per square foot of wind surface. A 16-ft. wind wheel has an area of 201 sq. ft., and should therefore supply in a 10-mile wind 201 foot-pounds of work per second, equivalent to 0.373 horsepower. From the equation y=188 x, it is found that the actual work represented by the water lifted is 0.198 horsepower, or 53 per cent of the maximum work that can be obtained from the wind. Allowing for the friction of the gearing and the loss of energy in the pump, the efficiency is satisfactory and the load on the pump is evidently suitable.

"A careful consideration of these results leads to several very important conclusions, which are evidently confirmed by the experiments on this mill. Although the maximum work which can be done by a windmill is proportional to the cube of the wind velocity, the actual amount of work which it does when pumping water is proportional to the wind velocity, because the work done depends upon the number of strokes of the pump, and the number of strokes of the pump depends upon the velocity of rotation of the windmill, and this, we have seen, is approximately proportional to the wind velocity. This result is fully borne out by these experiments, since the work done is found to be exactly proportional to the wind velocity.

"The practical meaning of this is that a windmill works with the greatest efficiency when the velocity of the wind is just sufficient to keep it in steady motion, and that at any other higher velocity of the wind but a portion of the useful work which the windmill could do is utilized. If a convenient arrangement could be devised whereby the load put upon the windmill varied with the square of the wind velocity the work done by these machines would be much greater. An attempt to realize this is made by the manufacturers who provide means whereby three different lengths of stroke of pump can be obtained; but in practice it is found inconvenient to alter the length of the stroke. The most satisfactory way to vary the load on a windmill is to provide it with two pumps worked through a rocking lever fixed at ground level. One pump can be permanently attached to the rocking lever and the other whenever the wind velocity is sufficient to justify doing so."

By examining all the records of hourly wind movements the author determined the total number of hours during the year when the wind was strong enough to have driven a second pump in addition to the first, and also the number of hours when a third pump could also have been driven. He found that, neglecting any work done by the wind when the average velocity was below 8 miles per hour, the total quantity of water raised by the windmill during the year would have been increased by 52.4 per cent if another pump could have been attached when the wind was favorable, and the addition of a third pump when the wind was sufficiently strong would have increased the work done by a further 24.3 per cent.

The author also examined the results that would have been obtained by the use of a 10-in. pump as compared with the 8-in. The 10-in. pump would have required a wind velocity of over 9 miles per hour before it could operate, but in the stronger winds it would have had so much greater capacity than the 8-in. that the total amount of water raised would have been practically the same for each month throughout the year as with the 8-in. pump. "All windmills arranged for lifting water should be arranged so as to be able to drive two pumps during periods when the wind velocity is sufficiently high."

RURAL ECONOMICS.

Some aspects of the organization of French agriculture, W. G. A. (*Dept. Agr. and Tech. Instr. Ireland Jour., 5 (1905), No. 4, pp. 653-666*).—This article is a discussion of agricultural cooperation in France.

There are local, departmental, and national organizations in France. "The local association is the school of true cooperation," while the larger associations can secure better terms in making purchases or sales and in securing favorable conditions of credit or of transportation. The cooperative associations have proved useful in the purchase of manure and seed, in the production of wine and spirits, in the sale of milk, live stock, grain, fruits, vegetables and flowers, in the establishment of credit banks which serve as savings banks as well as a means of securing loans at a reasonable rate of interest, in the development of a system of mutual insurance which safeguards the basis of credit, in the promotion of education, and in the improvement of rural social conditions.

"In French agriculture there is a new organic force which is continually manifesting itself in fresh vigorous developments. It is not simply an organization, it is an organism, which is at work. France is a country in which words representing what are called abstract ideas have a great influence and power of expression. The spirit of the new movement is best expressed in terms 'solidarité' and 'mutualité.' The principles of joint action, of combining to help one's self and one another, and of provision for the economic emergencies of life—of, in a word, social foresight—are underlying forces."

The economics of land tenure in Georgia, E. M. Banks (*Columbia Univ. Studies Polit. Sci., 23 (1905), No. 1, pp. 1-142, dgms. 8*).—This is an essay on landownership and tenancy in Georgia from the first settlement of the country to the present time.

Especial attention is given to the reorganization of southern agriculture after 1865, to the credit system, to the ownership of land on the part of negroes, and to the general characteristics of the negro farmer. The different plans of farming, based on the relations of the farmer to the soil, are summarized as follows:

"(1) The cropping system, in which the cropper is only to a slight extent manager and capitalist. The cropper is for the most part a laborer, and gets one-half of the crop wages. There are indications that the system has already begun to decline in Georgia.

"(2) The 'third and fourth' system, in which the renter is the chief manager and important capitalist, and pays the landlord one-third of the grain and one-fourth of the cotton as rent. This system has been rapidly disappearing, so that now it is found only here and there in the State. . . .

"(3) The 'standing rent' plan, in which the tenant is managing entrepreneur and capitalist. Under this plan the tenant pays the landlord a definite amount of the product—usually a fixed number of pounds of cotton. It has shown a great increase during the past decade.

"(4) The money rental plan represents the highest form of tenancy. In this the tenant is managing entrepreneur and capitalist. As yet this plan does not have a wide use in the State, though it, too, is on the increase. . . .

"(5) Small farms operated by owners. . . . Such farming is on the increase in Georgia.

"(6) The plantation system . . . gives scope for the exercise of a higher order of managing ability than does any of the others. It is farming on a large scale as opposed to farming on a small scale. . . . This method of farming is on the increase."

Water rights on interstate streams: The Platte River and tributaries, R. P. TEELE and E. MEAD (*U. S. Dept. Agr., Office Expt. Stas. Bul. 157, pp. 118, pls. 4, figs. 3*).—This report is a discussion of two features of stream ownership and control; one is the division of the water of the stream between States, and the other is the relation of the rights of appropriators of water and of riparian proprietors to each other where both exist on the same stream.

The total area irrigated by the Platte River and its tributaries is about 2,000,000 acres. Most of the irrigated lands upon the South Platte River are in Colorado, but the farmers of other States make extensive use of the waters of the North Platte. The area irrigated from the North Platte and its tributaries in the three States is as follows: Colorado, 157,965 acres; Wyoming, 413,000 acres; Nebraska, 338,220 acres. With these important interests in three States and with a tendency for the farmers farther up the river to increase their diversions of water, the importance of some form of interstate agreement or Federal regulation becomes apparent.

The average flow of the North Platte at Guernsey from April to September is 4,013 cu. ft. per second, and the decreed rights to water from the North Platte and Platte below the point of its junction with the South Platte aggregate 11,173 cu. ft. per second, or nearly three times the supply. This situation is well understood, but the need of water and its prospective value is so great that appropriations are being made more aggressively than ever before.

Fortunately it happens that the physical conditions are such that Colorado will not be able to appropriate much of the water now being used by the Wyoming farmers. The irrigable areas along the North Platte in Colorado are very limited and most of the appropriations from the North Platte in Wyoming are in the last 30 miles of the river's course in that State, and because of the long distance between this irrigated region and Colorado it is not probable that use in Colorado will affect Wyoming irrigators. In general it seems to be true that a very large proportion of the water diverted for purposes of irrigation finds its way back sooner or later to the river, so that the same water may be used several times along the course of the stream, and the higher up the stream the water is first diverted the greater the area which may be made productive by its use.

While the diversions of water from the North Platte River in Colorado seem to make no difference in the flow of that river near the Wyoming-Nebraska line, it seems to be true also that the diversions of water in Wyoming near the Wyoming-Nebraska line have little influence upon the flow of the river 180 miles below the State line near the city of North Platte. A large number of irrigators and ditchmen in the vicinity of North Platte and along the ditches below that city were interviewed and none of them seemed to feel that the diversions in the upper States diminished their supply of water.

The general sentiment seemed to be that the increased use of water in Wyoming and along the upper valley in Nebraska would improve rather than injure the supply for the ditches below. The supply for these ditches has always been short in the late summer, and can not be much worse. There owners, therefore, look with favor upon the enlarged use of water above in flood seasons in the hope that the return seepage will maintain the flow below in the late summer.

So important is the element of return seepage that it is believed there is little likelihood of any interstate conflict on the North Platte unless it should be between ditches heading close together immediately above and below the State line. If the State of Wyoming should grant the right to divert all of the water flowing in the river immediately above the State line, without regard to the diversions which have been made under the laws of Nebraska just below the State line, the agricultural interests of the latter State would be seriously injured, but if the prior rights in Nebraska are recognized by Wyoming no serious conflict should arise.

The general conclusion is reached that "under existing physical conditions and in view of the dates of the acquirement of existing rights, the enforcement of rights as based on the laws of the three States will do no substantial injustice to the irrigators in any one of the States. As between the States, therefore, the whole question resolves itself into the matter of distributing the water of these streams to existing rights regardless of State lines. This can be accomplished by agreement between the States, and if it is not done in that way justice will demand that the Federal Government provide for this distribution."

On the subject of water rights within States this report emphasizes the importance of retaining the ownership of the water in the possession of the owners and operators of the land. The character of water rights in different States is discussed with reference to their influence upon the ownership of water. In Colorado the right to a certain number of cubic feet of water per second is granted to ditch companies, whereas in Wyoming and Nebraska the certificate of appropriation names the appropriator and the diverting ditch, but gives to the land described a right to water sufficient for its irrigation, fixing, however, a maximum limit to the amount which can be taken.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 7 (1905), Nos. 3-6, pp. 17-54*).—These numbers for July, August, September, and October, 1905, contain reports on crop conditions in the United States and in foreign countries, the visible supply of grain and cotton in the United States, foreign trade in agricultural products, the prices of agricultural products, the consumption of wheat per capita in the principal importing and exporting countries, and the new German tariff on agricultural products in its relation to exports from United States to Germany. The August number contains a comprehensive review of the British fruit market.

Measures for the advancement of agriculture in Iceland, S. SIGURDSON (*Tidsskr. Norske Landbr., 12 (1905), No. 6, pp. 284-288*).

MISCELLANEOUS.

Eleventh Annual Report of Montana Station, 1904 (*Montana Sta. Rpt. 1904, pp. 178-278*).—This contains a financial statement for the fiscal year ended June 30, 1904, a report of the director, and departmental reports, parts of which are abstracted elsewhere.

Twenty-Seventh Annual Report of North Carolina Station, 1904 (*North Carolina Sta. Rpt. 1904, pp. 127*).—This contains reports of the director and heads of departments on the work of the station during the year; a financial statement for the fiscal year ended June 30, 1904; an article on The Availability of Potash and Phosphoric Acid in the Soil, abstracted elsewhere; reprints of 5 press bulletins and of Bulletins 186-189 of the station on the following subjects: Insect and fungus enemies of the peach, plum, cherry, fig, and persimmon (E. S. R., 15, pp. 591, 594); grapes and small fruits (E. S. R., 15, p. 585); the Granville tobacco wilt (E. S. R., 15, p. 684); feeding farm horses and mules (E. S. R., 15, p. 901).

The subjects of the press bulletins are as follows: To prevent the black rot of the grape, the watermelon wilt, a dangerous tobacco disease, black rot of the cabbage, and the silk-growing season of 1904 (see p. 480).

Twenty-Third Annual Report of Ohio Station, 1904 (*Ohio Sta. Bul. 152, pp. XXV*).—This includes an announcement concerning the work of the station; the organization list; brief biographical sketches of F. Whittlesey, J. H. Brigham, S. H. Ellis, and J. F. Hickman; a report of the board of control; a financial statement for the fiscal year ended June 30, 1904; and a report of the director summarizing the work of the station during the year.

Fourteenth Annual Report of Oklahoma Station, 1905 (*Oklahoma Sta. Rpt. 1905, pp. 15–66*).—This contains a report of the director, a summary of the press bulletins issued during the year, meteorological observations noted elsewhere, and a financial statement for the fiscal year ended June 30, 1905.

The press bulletins are to a large extent a repetition of matter published in the regular bulletins of the station. The subjects treated include: Texas fever ticks, distribution of vaccine for blackleg, protecting Bermuda grass, spelt or emmer, growing cowpeas, harvesting and storing cowpea seed, corn smut, cultivating corn, cotton culture, cotton seed and cotton-seed meal for dairy cows, rations for dairy cows, apple scab, destroying insects and fungi, and preservatives in cream. Some of the press bulletins containing new matter are noted elsewhere in this issue.

Press bulletins (*Ohio Sta. Bul. 152, pp. 209–216*).—Reprints of press bulletins on the following subjects: Distribution of chinch-bug fungus; spraying for grape rot; a wheat with numerous aliases (see p. 462); the corn crop; dodder in alfalfa and clover seeds; testing seed corn; some common orchard scale insects; lime is not a fertilizer; annual picnic at the experiment station; and the Hessian fly and the wheat midge.

Agricultural directory for Denmark, 1905, H. C. LARSEN (*Landökonom. Aarbog [Copenhagen], 6 (1905), pp. 188*).—This is a complete directory of Danish agricultural public institutions and societies for the promotion of Danish agriculture in its various branches. A list of agricultural periodicals and books published in Denmark during 1904 is included in the directory.—F. W. WOLL.

Report of the agricultural department of Norway, 1904 (*Aarsber. Offentl. Foranst. Landbr. Fremme, 1904, pt. 1, pp. LXXXI+595*).—The report gives the usual accounts of the various agencies for the improvement of Norwegian agriculture, with reports on the harvest of 1904, special reports by the government agricultural engineers, entomologist, instructors, horticulturist, and dairy experts; also reports of the agricultural experiment stations, the milk control stations, dairy control associations, and horticultural and dairy schools. A summary of the average temperatures and precipitation for the year is given at the close of the volume.—F. W. WOLL.

Report of the agricultural department of Sweden, 1903 (*K. Landtbr. Styr. Underdåniga Ber. 1903, pp. 420+V*).—The report contains the usual accounts for the year of the agricultural institutions for the advancement of Swedish agriculture, the agricultural societies, agricultural and dairy schools, agricultural engineers and instructors in the various agricultural branches. A summary report of the work of the state chemical stations and seed control stations for the year is included at the close of the volume.—F. W. WOLL.

Southern Rhodesia (*London: British South Africa Co. [1905], pp. 155, figs. 124, map 1*).—A book containing general information of value to settlers. Brief statements regarding the different agricultural pursuits of the country are given.

Vademecum for the agriculturist, R. and H. HITSCHMANN (*Vademekum für den Landwirt. Vienna: M. Perles, 1905, 11. ed., pp. XVI+1286, ill.*).

NOTES.

Alabama College and Station.—L. N. Duncan, a graduate of the Alabama Polytechnic Institute in the class of 1900, has been appointed assistant in agriculture in the college and station. Fifty steers are now being fed to ascertain the relative values of southern feeding stuffs. This is a repetition of a similar experiment made in the winter of 1904–5. This work is conducted in cooperation with the Bureau of Animal Industry of this Department, as was that of last year.

California University.—A large and successful gathering of public school officers, teachers, and farmers' institute workers was held at the university December 26–29, 1905. Over 7,000 were in attendance. The subject of agricultural education was in the foreground and was discussed from various points of view. The meeting was attended by Dr. A. C. True, of this Office, who presented papers on Why the Friends of Agricultural Progress Believe that Agriculture should be Taught in the Public Schools, and A System of Agricultural Education for California. L. D. Harvey, superintendent of the Stout Training Schools, Menomonie, Wis., gave addresses on Experiments in Agricultural Education in this and other Countries and what they Should Teach us, and Industrial Education—its Scope, Purpose, and Place in the Public School System. Professors Hilgard, Wickson, and Woodworth, of the university, and Director Anderson, of the Polytechnic School at San Luis Obispo, participated in the discussion of these papers.

A new entomological laboratory was dedicated December 27, the principal address being given by Prof. C. W. Woodworth. This laboratory, which is for the use of both college and station, occupies the whole of a building with three stories and a basement. The basement is devoted to the work in spraying; the first story contains large class rooms for undergraduate students; the second story has a number of small rooms or cells for individual advanced students, together with larger rooms for seminars and the collections, and the third story contains several research laboratories, an insectary, illustration room, and microphotographic room. Some 200 students are taking courses in entomology.

Purdue University and Station.—The first seed-corn special train ever run in the State was run over the Lake Erie road from December 26 to 30. The railroad furnished the train free of charge, and the advertising was looked after by one of the prominent newspapers of the State without expense to the station. The latter furnished the speakers and necessary illustrative material. The trip is reported to have been a very decided success. The farmers turned out well at practically all the stops, even in the rain and snow of the last two days. Large audiences were present at the evening meetings. Altogether more than 10,000 farmers were addressed.

O. F. Hunziker, formerly connected with the New York Cornell Station, has been appointed dairyman in the university and station, to succeed H. E. Van Norman, who has gone to the Pennsylvania College and Station.

Louisiana Station.—R. C. Holtzclaw, chemist at the State Station at Baton Rouge, has resigned to accept a position with the Virginia-Carolina Chemical Company. D. N. Barrow, assistant director at the North Louisiana Station at Calhoun, has also resigned. J. G. Lee, for a number of years commissioner of agriculture of the State and formerly assistant director at Calhoun, has been selected to fill the vacancy.

Massachusetts College.—At the meeting of the board of trustees early in January, Kenyon L. Butterfield, president of the Rhode Island College of Agriculture and Mechanic Arts, was elected president. President Butterfield has accepted the position and will enter upon his duties in July.

Nebraska University.—The new agricultural hall was dedicated January 16. The principal address was delivered by Hon. W. G. Whitmore, a regent of the university, on Some Problems Confronting Nebraska Farmers.

Cornell University.—Two new short courses for women are being offered by the college of agriculture this winter, one in horticulture and the other in home economics. About 20 women of prominence in the latter subject have been engaged to give lectures and demonstrations in connection with the course, which is intended primarily for the benefit of farmers' wives and daughters. The college is also offering a correspondence course for teachers in the rural schools in home nature study, including the study of birds, plants, trees, insects, and fishes.

Pennsylvania College.—Leave of absence has been granted Dr. G. W. Atherton for the winter on account of the condition of his health. Dr. Atherton has expressed to the board of trustees his desire to relinquish the duties and responsibilities of the presidency, and in accordance with this wish a subcommittee has been appointed to consider the subject of a successor. Dr. W. A. Buckhout will act as president in the interim. It is announced that Dr. Atherton will retain connection with the college as lecturer in his special department.

Rhode Island College and Station.—During the past year the small poultry buildings of the station have been entirely overhauled and repaired, and freshly painted. New fencing has been provided and the entire plant put in a very much improved condition. This has been rendered possible by a State appropriation made a year ago. The new instruction house and brooder house for the college, for which an appropriation was made last winter, was completed in season for use by the poultry course, which began January 2 and will continue for 12 weeks.

James W. Kellogg, formerly first assistant chemist to the station, but since May, 1905, employed as expert in the Bureau of Soils and engaged in cooperative work at Kingston, has resigned to accept a commercial position. No provision for the appointment of his successor has yet been made.

South Carolina College and Station.—H. Metcalf, associate professor of botany and bacteriology in the college, and botanist and bacteriologist of the station, has resigned to accept a position as pathologist in the Bureau of Plant Industry of this Department. Dr. Metcalf will be succeeded by Homer D. House, of the Bureau of Plant Industry of this Department. A greenhouse which will cost $6,000 is now being built. The center of this building will be assigned to the horticulturist, and an end each to the botanist and entomologist of the station.

The Southern Railway has loaned the college a modern day coach which is hauled free of cost by all the railroads of the State. This coach has been equipped with exhibits from the various departments and divisions of the college, and is accompanied by institute lecturers from the college, station, and elsewhere. In November, December, and January thirty-two points were visited and farmers' institutes held in the southern half of the State, the northern half having been covered the past summer. It is hoped that this feature of holding farmers' institutes in cooperation with the railroad may be permanent. The coach attracted an unusual amount of attention and was visited by thousands of people.

South Dakota College.—Robert L. Slagle, president of the State School of Mines, succeeded James Chalmers as president of the Agricultural College, January 1, Dr. Chalmers having gone to the State University.

Ohio University.—J. A. Foord, professor of agriculture at Delaware College, has accepted the position of assistant in agronomy at the university.

Vermont University and Station.—F. M. Hollister has resigned as assistant chemist to enter the medical college of the university. The medical college building, erected at a cost of $100,000, dedicated at commencement in June last, was occupied December 1 at the opening of the year. Experiments in horse breeding, using Morgan blood as a basis, are to be undertaken in cooperation with the Bureau of Animal Industry of this Department. A barn on a farm owned by the university is being

moved and enlarged with a view of using it for this purpose. It is expected to make the initial herd consist of a stallion and ten mares.

Virginia Station.—The series of feeding experiments with beef cattle undertaken the past year showed that animals receiving silage gained 1.46 lbs. per head per day, those receiving timothy hay 1.10 lbs., and those receiving shredded stover 0.97 lb. The silage ration was clearly the most profitable and satisfactory in every way. In investigations with dairy cattle, timothy hay and shredded stover were shown to have about the same feeding value. Cotton-seed meal was slightly more profitable for the production of milk and butter than gluten meal. The beef and dairy experiments are being continued this year. Eighty-four cattle are in the beef feeding pens. Of this number 48 are being fed for 180 days for immediate slaughter to determine the relative merits of different forms of grain fed with silage and stover. The remaining 36 are being fed as stockers to be grazed next summer.

These experiments represent the beginning of important tests to determine the relative merits of making beef in the stall and on grass; also to determine the best way to maintain cattle through the winter and finish them for export purposes. Breeding experiments have been commenced with various crosses of pure-bred sires on native and grade cows, and as the station has 6 pure-bred herds available for this work, together with a herd of 100 grade animals, the facilities for investigation are very good.

Wyoming University and Station.—The short course for ranchmen was held at the university and station January 5 to 13, 1906. The station has decided to sell its stock of breeding horses and strengthen its work in sheep, swine, and cattle breeding. The station met with a serious loss in the death of Polled Admiral, a Double Standard Polled Hereford bull, but a number of calves are on hand which give promise for the future of this new breed.

Meeting of Association of Horticultural Inspectors.—The association held its annual meeting at Washington, November 14–16, 1905. During the meetings thirty-two persons, representing twenty-two different States, took part in the proceedings. A committee representing the National Nurserymen's Association was also present and participated in the conference. The idea which dominated the discussions was that of securing uniformity of legislation, inspection requirements, certificates, tags, and other official procedure in connection with the inspection of nursery stock. An attempt to secure uniformity in these particulars was considered necessary in order to simplify the business of inspection, and to reduce the burden upon transportation companies and nurserymen incident to the different systems prevailing in different States.

In pursuance of this object the first topic discussed related to the essential features and requirements of uniform State legislation controlling the inspection of nurseries, and the methods by which such uniformity of State legislation may be secured. J. B. Smith argued that each State should properly provide for inspection and license, and tagging of nursery stock. If all States would admit nursery stock without hindrance and treat the stock afterward in the same manner as required for stock from local nurseries uniformity in this matter would be secured in part.

As it is at present, inspection tags are generally disregarded, for the reason that crown gall and certain other diseases may escape the attention of the inspector of the State from which the nursery stock comes, especially if such inspection be made before the nursery stock is dug. It was urged that all reasonable efforts should be made to secure such changes in the peculiarities in the laws of different States as will tend toward a greater uniformity. It was argued that a Federal law, if such be possible, might have this effect.

Attention was called by S. A. Forbes to the fact that there are three chief points in the lack of uniformity in the inspection laws of different States. These points concern the license requirement, tag system, and fumigation requirement. Following upon this statement the association proceeded to discuss these three points.

H. E. Summers stated that San José scale does not live over the winter in most parts of Iowa. It appears useless, therefore, to require the fumigation of stock from localities where the scale is not known.

During the discussion of fumigation it was pointed out that a general opinion prevails among nurserymen and orchardists that fumigation injures trees. Much evidence was presented on this point, the general belief of the inspectors present being against this idea. As a result of the discussion, a resolution was adopted requiring fumigation before nursery stock is set out. Opinion was against the requirement of a State license fee from nurserymen, and a resolution to that effect was adopted.

In certain States outside nurserymen are required to present with their stock tags issued by the inspector of the State to which it is sent. Regarding the desirability of this, some of the inspectors urged that certificates serve every purpose which tags can, while others had found the tag system the only method by which the inspector can keep account of nursery stock sent in from outside sources.

The representatives of the National Nurserymen's Association stated that nurserymen do not object to the severity of present inspection requirements and would not make any opposition if such requirements should, in the future, become even more severe. They do, however, want a uniform system of tags, or, if this is impossible, the complete abolition of the tag system. It was argued by the nurserymen that the present system of different styles of tags and different requirements in different States is a source of great annoyance and delay. The present plan is too complicated, and some nurserymen are unable to understand exactly what is required of them in shipping stock into certain States.

As a result of this discussion it was decided to appoint a committee of three to devise a suitable tag which will be recognized by all States requiring tags, the tag to convey the assurance that the nursery stock had been fumigated.

In order to secure a uniform certificate which would be adapted to both nurserymen and dealers, a form of certificate was adopted certifying inspection of nursery stock "for sale by" the individual who applies for the certificate.

As a result of the discussion of the present condition of nurseries in different States, the methods adopted for freeing them from infestation, and the success of such methods, it appeared that in this respect quite different conditions prevail in the various States. In some States the percentage of infested nurseries and the extent of infestation have increased, despite all the efforts to the contrary; while in others a number of previously infested nurseries have become entirely clean as the result of more or less stringent insecticide methods.

A quite uniform system of procedure is in vogue among the inspectors of the various States represented at the meetings. Infested stock in the nursery rows is destroyed, and all stock from such nurseries is required to be fumigated before being shipped. Usually a second inspection is made, and sometimes subsequent inspections, in order to determine whether other infested stock is present in the nursery or not. To facilitate and make effective the work of the tag committee, it was resolved that the condition of all nurseries which wish to do interstate business should be made known to the committee.

Another topic discussed during the meeting concerned recent additions to the knowledge of insecticide measures against the San José scale. J. B. Smith stated that he still adheres to petroleum as the best remedy for destroying the San José scale on apple trees. A special study has been made of soluble oils, or rather oils which are readily miscible with water. A number of proprietary preparations have been made, some of them at the suggestion of the speaker. In general, these preparations are made by treating an animal or vegetable oil with sulphuric acid and then combining the mixture with petroleum.

The compound thus produced mixes much more readily with water than untreated oil, and the mixture is much more stable. In some cases, it was stated, that a mixture

had been preserved for six months without showing any separation of the oil and water. With this mixture it was found perfectly safe to treat apple trees as soon in the fall as the leaves mature; it is not even necessary to wait until the leaves have fallen. In this work less than 2 per cent of actual petroleum was sprayed on the trees. The cost of the insecticide was about the same as lime-sulphur wash; the latter, however, is recommended as the best preparation for use on peach trees.

L. R. Taft had excellent results in recent experiments with proprietary soluble petroleum compounds, but still prefers lime-sulphur wash. In Illinois the soluble oil compounds proved to be equally effective with lime and sulphur, but somewhat more expensive. It was found undesirable, however, to use the lime and sulphur during midwinter. Apparently better results are obtained when these compounds are used in the spring or fall. In recent experiments by numerous inspectors Con-Sol proved to be practically useless. The kerosene-limoid mixture in recent tests in Ohio and Delaware also gave poor results.

The association also discussed the points which should be covered by an inspection certificate. In this discussion it appeared that in New Jersey and some other States a certificate is given subject to the right to a second inspection before the trees are removed from the nursery rows. An inspection in July without reinspection is considered of no value. In Ohio the requirements of the law make it necessary to inspect nurseries rather early in the season. The point was emphasized, however, by all who took part in the discussion that nurseries should be inspected as late in the season as possible.

In order to secure uniformity of certificates and inspection it was recommended that a standard list of dangerous pests be prepared. As a result of this discussion a committee was appointed to draw up such a list, and this committee was later continued in order to enable it to complete its work.

Nearly all of the inspectors had experienced great difficulty in drawing a sharp line between nurserymen and dealers. It was recognized that there are certain dealers who virtually raise no nursery stock of their own. On the other hand, all nurserymen trade stock with one another and buy and sell. In some cases even the largest nurserymen buy more stock than they raise on their own premises. This fact brings into prominence the difficulty of issuing certificates which shall cover the nursery stock raised on the premises inspected, and also other stock bought in other States with another inspector's certificate, but not inspected by the local inspector.

After discussing this matter a resolution was passed to the effect that a nursery in the inspectors' sense is any place where hardy fruit or ornamental trees, vines, shrubs, and plants are grown for sale or distribution.

The inspectors took up the discussion of the attitude of commercial fruit growers toward the inspection work for the control of San José scale. In general the reports of different inspectors on this point indicated clearly a growing feeling among the orchardists and commercial fruit growers of the importance of inspection by competent inspectors and thorough application of standard insecticides.

In Maryland and New York orchards are inspected as far as the funds of the inspection service permit. In New Jersey orchardists have the right to request inspection. In general, however, it appears that in this State the orchardists are not much concerned about the condition of nursery stock for the reason that they must, in any event, fight the San José scale, and long experience has taught them effective methods for its control. In Illinois from $6,000 to $8,000 are spent annually on orchard inspection.

At the suggestion of H. T. Fernald, who sent a short paper to be read at the meeting, the inspection for gypsy moth and brown-tail moth was discussed. Attention was called to the great difficulty of inspecting nurseries for these pests. The requirements of the Massachusetts law make it necessary to inspect nursery stock at a season before the eggs of the gypsy moth are laid. It appears quite possible that

both of these insects may ultimately be distributed throughout the United States on nursery stock. The brown-tail moth is spreading with great rapidity.

Following this discussion a resolution was adopted recommending Federal aid in controlling the gypsy moth.

Discussing the present state of knowledge regarding crown gall and practical measures to prevent the distribution of nursery stock affected by this disease, C. P. Gillette stated that this is a very serious pest in Colorado, and special precautions are taken to prevent its introduction. The point was made by another speaker that there may be several kinds of crown galls. Crown gall of peach trees appears to differ from that of apple trees and, according to certain investigations, so-called hairy root of the apple may be different from the hard crown gall of apple trees. A resolution was passed holding it to be advisable to destroy all trees and plants which show crown gall at the time of digging.

In a discussion of the woolly aphis problem it appeared that nursery stock infested with this insect may either be destroyed, fumigated with hydrocyanic-acid gas, or dipped in some other insecticide.

The officers elected for the coming year were S. A Forbes, president; J. B. Smith, vice-president, and A. F. Burgess, secretary

International Veterinary Congress.—This congress held its eighth session in Budapest, September 2–7 last. A variation was made in the programme of former years in that the discussions were not confined so exclusively to veterinary service proper, but to other related lines of veterinary work. There were four sections of the congress, namely, veterinary service, biology, pathology, and tropical diseases.

While several animal diseases were brought to the attention of the congress and claimed some interest from the members, the relation between human and bovine tuberculosis continued to be the chief subject of discussion. The propositions maintained by the disciples of Koch at this congress were that the two distinct types of tubercle bacillus, the bovine and human, are not capable of modification the one into the other; that spontaneous infection of cattle with the human type of tubercle bacillus does not occur; and that the bovine type of the bacillus rarely occurs in man.

In opposition to this view de Jong, Preiss, and others held that human tubercle bacilli are identical with those found in mammals but apparently distinct from the avian form. The congress finally adopted resolutions to the effect that bovine tubercle bacilli may infect man, that in man tubercle bacilli are sometimes found which may infect cattle, that avian tuberculosis requires further study in order to determine the identity of the bacillus which causes the disease, and that all precautions hitherto recommended should be rigidly maintained in order to prevent the transmission of tuberculosis from animals to man.

In discussing the method of infection with tuberculosis in domesticated mammals, Lorenz considered that cattle are most concerned in this transmission and that all of the excretions and secretions, especially milk, may be virulent. According to Bongert, Arloing, and Bang, the disease is never transmitted by germinal heredity, and any acquired or inherited tendency toward tuberculosis plays a comparatively unimportant rôle.

In regard to the means of controlling traffic in milk and the principles upon which to proceed in this matter, it was resolved by the congress that courses in practical hygiene of milk and milk bacteriology should be introduced into the curriculum of all veterinary schools; that strict attention should be given to securing milk free from tubercle bacilli for the use of children; and that in order to secure this condition it should be required that all milk offered for public sale be absolutely free from dirt.

International Congress of Tuberculosis.—The fourth session of this congress was held in Paris, October 2–7, 1905, under the patronage of President Loubet. The congress was divided into four sections—medicine, surgery, protection of children, and social hygiene. The discussions were largely concerned with tuberculosis in man. Pro-

fessor von Behring presented some of the details of his plan of immunizing children as well as cattle to tuberculosis.

The congress adopted a resolution to the effect that sanitary inspection of dairies should be put in force, wherever possible, at the earliest moment, and that milk designed for public use should be pasteurized, boiled or sterilized, or otherwise should come from cows which have been tested with tuberculin and shown to be free from tuberculosis.

Higher Agricultural Education for Great Britain.—A deputation recently waited upon the board of agriculture in London to urge the necessity of proper provision being made throughout the country for research and higher education in agricultural science. The deputation consisted of representatives of the Universities of Cambridge, Leeds, Wales, and North Wales, Armstrong College, University College of Reading, Midland Agricultural and Dairy Institute, Harper-Adams Agricultural College, Southeastern Agricultural College, Carnarvonshire and Derbyshire County Councils, and other local authorities.

It was urged that if English agriculture is to hold its own in the face of increasing foreign competition, English agriculturists should be enabled to bring to their work a scientific knowledge and training in scientific methods such as are placed at the disposal of foreign rivals. Representatives of the board of agriculture expressed the fullest sympathy with the work which the colleges had done and with the object of the deputation, and indicated their readiness to lend the movement such aid as was in the power of the board.

Agricultural Education in Denmark.—The report of the trip of the Scottish Commission on Agriculture to Denmark, June 19–30, 1904, devotes about 14 pages to education, including a brief description of the following features of the Danish system of schools: (1) The common school system. (2) The people's high schools, private institutions, some of which were established as early as 1845, and now numbering 78, attended by about 6,000 young people of both sexes between 18 and 25 years of age. From the first these schools gave instruction in land surveying, agricultural chemistry, and other sciences underlying the practice of agriculture; but when agriculture developed and increased in importance this provision proved inadequate, and hence arose a necessity for the establishment of purely agricultural schools.

(3) The agricultural schools, which are branches from the high schools, having agriculture and the natural sciences for the principal subjects of instruction. There are now 44 of these schools, 14 maintained entirely separate from the high schools, 1 a separate dairy school, and 29 associated with high schools. Admission to these schools is limited to persons from 18 to 25 years of age who have had at least one year's experience in practical farming. A demonstration station is connected with the agricultural school at Dalum and experiment stations with those at Ascov and Lyngby.

(4) The Royal Veterinary and Agricultural Institute at Copenhagen, which enrolled during the year preceding the visit of the commission about 300 students, 130 of whom were students in agriculture proper, while the remainder were students of forestry, horticulture, land surveying, and veterinary science. State aid to the Royal Veterinary and Agricultural College amounted in 1904 to $71,780, and to experiment stations and demonstration fields to $14,550. The people's high schools and agricultural schools were also aided by the Government to the extent of $37,345.

Experiment Stations for Cape of Good Hope.—A separate from an article in *Science in South Africa* states that it has been definitely decided to establish experiment stations in the Cape of Good Hope, and that Parliament has voted the funds necessary for commencing this work. The plan will not be to establish "one large and elaborate institution, but rather a number of small separate stations, each working out the problems of its own region; . . . it has been decided to make the work in the first instance eminently practical, to restrict it to questions that will appeal at once to the pockets of the people, deferring to a later stage the study of matters less immediately

advantageous." This movement for experiment stations is said to have aroused a good deal of public interest.

County Instructors in Agriculture in Ireland.—The Department of Agriculture and Technical Instruction for Ireland announces that it is prepared to assist county committees in securing instructors in agriculture, poultry keeping, horticulture and the management of bees, and butter making, one instructor in each subject for each county. The duties of these instructors will be to deliver courses of lectures, visit farms, conduct experiments and demonstrations, assist in teaching agricultural classes provided for by the department, correspond with farmers, and otherwise advise them.

Nebraska Boys' and Girls' Associations.—The boys' and girls' corn and cooking contest held at the school of agriculture, Lincoln, December 14 and 15 (E. S. R., 17, p. 310), was attended by over 500 boys and girls, many of whom were accompanied by their parents or teachers. The corn contest included over 200 exhibits of corn grown by the boys, and the cooking contest showed many articles of cooked food prepared by the girls. Two permanent State organizations were formed, designated, respectively, the Boys' Agricultural Association and the Girls' Domestic Science Association, with the superintendent of public instruction ex-officio manager of both.

The programme of the meeting included addresses by a number of men and women of prominence, among whom were Gov. J. K. Mickey, State Superintendent of Public Instruction J. L. McBrien, Chancellor E. B. Andrews of the university, Prof. John Hamilton of this Office, Prof. E. A. Burnett, and other officers of the college and station, State normal schools and other educational institutions. The crowning event was a corn banquet at which 700 plates were spread.

National Dairy Show.—The National Dairy Show is to be held at Chicago, February 15–24, under the auspices of the National Creamery Buttermakers' Association. The large Coliseum building will be used for the show, which will include exhibits of milk and other dairy products, dairy manufactures, machinery and accessories, and materials "of every character in which the producer, the manufacturer, and the consumer of dairy products are interested in any way whatever." There will also be a showing of dairy cattle.

Miscellaneous.—P. L. Hutchinson, for several years connected with the Louisiana Sugar Experiment Station at New Orleans, and since last summer a special field agent of this Department in connection with the collection of cotton statistics, died at Memphis, Tenn., January 2.

George F. Thompson, editor in the Bureau of Animal Industry, and a writer on Angora and milch goats, died of pneumonia, January 6.

C. C. Georgeson, in charge of the Alaska stations, has returned to Washington for a few weeks.

A. V. Stubenrauch, of the California College of Agriculture and Experiment Station, has resigned to accept a position as special agent in fruit transportation and storage in the Bureau of Plant Industry of this Department. His appointment took effect January 1.

Lyman J. Briggs, of the Bureau of Soils, was transferred at the beginning of the year to the Bureau of Plant Industry, where he will serve as physicist in connection with investigations in vegetable physiology.

Ernest H. Bessey, of the Bureau of Plant Industry, has been placed in charge of the subtropical laboratory of the Bureau at Miami, Florida, vice P. H. Rolfs, who, as previously noted, has become director of the Florida Experiment Station. The laboratory will hereafter be run in close cooperation with the Florida Station.

Major D. Prain, director of the Botanical Garden at Calcutta, has been appointed director of the Kew Gardens, succeeding Sir William Thiselton-Dyer, retired.

Burton E. Livingston, of the Bureau of Soils, has resigned to accept a position in the Desert Laboratory of the Carnegie Institution, at Tucson, Arizona.

Samuel Fraser, assistant agronomist at the Cornell University and station, has been appointed soil expert in the Bureau of Soils.

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The joint meeting of the State Teachers' Association and the State Farmers' Institute at Berkeley, Cal., December 26–29, 1905, was of unusual interest to the friends of agricultural education. It was an unusually large meeting, over seven thousand persons being present at the various meetings of the sections. In this way representative school officers, teachers, and farmers were enabled to come into close personal touch and to discuss educational problems from a variety of standpoints.

The United States Government was represented by the Director of this Office and the State government by the governor, superintendent of public instruction, and other officials. Matters relating to the general interests of education throughout the country were presented by Superintendent L. D. Harvey, of Wisconsin, and A. E. Winship, editor of the *Journal of Education*, Boston. Most of the sessions were held in buildings of the University of California, and President Wheeler and a considerable number of members of the university faculty took part in the meetings. Other universities and the normal schools were also represented. The interests of various grades of schools from the university down to the kindergarten were discussed. Members of the legislature, city officials, editors, librarians, farmers, and business men also participated.

It was, therefore, of unusual significance that at such a meeting the claims of agricultural education to a place in the public school system in secondary and elementary schools, as well as in the college, were elaborately and earnestly presented and discussed by a considerable number of speakers. More significant even was the general atmosphere of sympathy with the idea that the industrial element must in one form or another become a permanent and pervasive constituent of our public school system.

This was impressively enforced by the earnest and thoughtful address of Governor Pardee, in which unanswerable statistics were made to show that the children, and especially the boys, were in the vast majority of cases leaving school at so early an age that the schools were making little impression on their minds or characters; that there was little in the school curricula to aid them in their life work, and

that as a result of the present educational conditions very many of the youth of the State at the best were becoming inefficient industrial workers or at the worst were drifting into criminal courses.

Thus it was made easier for other speakers to emphasize the importance of the industrial element in education as a means both of holding children longer in the schools and of training them for the actual duties of life. And in the discussion of industrial education it was made plain that in order to prepare the children of the country for life on the farm and to interest them in the business of farming as a life work, the atmosphere of the rural schools must be favorable to country life, and the instruction in these schools must open the minds of the children to the rational interest which may be connected with farming, and to the aid which the farmer may get from the application of science to his art.

Ample opportunity was given for the presentation of various phases of the problem of agricultural education. The progress which has been made in different States and foreign countries in introducing instruction in agriculture into the schools was also shown. That there was great public interest in the question of agricultural education was evidenced by the relatively large attention which was given to this feature of the meeting by the press throughout the State.

The importance of such a meeting at this juncture is relatively great, because it gives the friends of agricultural education an opportunity to reach the great body of school officers and teachers, whose support must be enlisted before any scheme for agricultural instruction in the public schools can be made effective in our educational system. It helps, moreover, to give the general public some idea of what is really involved in such instruction in the public schools and to remove erroneous notions of the extent and character of the proposed innovation.

The important fact was brought out that already some instruction in agriculture and closely related subjects is being successfully given in quite a number of schools in California, and an organization was formed for the more definite formulation of school courses in this subject for use in the public schools throughout the State.

The California meeting is an impressive evidence of the interest which in many parts of the United States is now being manifested in the wider diffusion of agricultural education. By bringing schoolmen and farmers together to discuss this question the Californians took a course well adapted to promote the cause of agricultural education, and it is hoped that this line of effort may be repeated in the near future in many States.

The decision to establish an institute of animal nutrition is the latest step in the direction of specialization in agricultural investigation.

This was determined upon at a recent meeting of the board of trustees of the Pennsylvania State College, and will be put into effect at an early date. As an outgrowth of experiment station work the matter is of unusual interest, and as indicating a determination to make the investigation in this line an even greater feature at the Pennsylvania Station it is matter for sincere congratulation.

The institute will correspond in organization and general character to the institutes common at European universities. The action is in effect the elevation of this important department of research to a position coordinate with that of the experiment station itself, and in a sense independent of it. It will be conducted as a department of the college and will be presided over by a separate director responsible to the college authorities, but will be affiliated with the station in its work. The organization, therefore, is different from anything we have had in the past.

Dr. H. P. Armsby, who has been since 1888 director of the Pennsylvania Station, has been indicated as the director of the new institute. As such he will be relieved of all duties relating to the general administration of the experiment station, and will be left free to confine himself to his special lines of research. Coming as it does at the close of a long period of service, in which Doctor Armsby has displayed high ability as a research worker in this field, this action of the board is to be regarded as a marked compliment to him and a declaration of confidence and appreciation. It is a decided promotion, carrying with it greater freedom and opportunity, and is understood to be entirely in accord with Doctor Armsby's tastes and wishes.

There would seem to be great opportunity for an institute of this character. Its work will be of interest and value to all the stations and to the science of animal nutrition. It will conduct investigations which very few stations are in position to undertake on account of the expense involved, the intricate apparatus and equipment required, and above all the indispensable special training. The work is not spectacular and not likely to appeal so strongly to men looking for immediate practical ends. Support for it must come mainly from investigators and others who appreciate its importance. It calls for a patient investigator, who is a thorough scholar in disposition and temperament, and is content to make haste slowly. In all these respects Doctor Armsby will be recognized as preeminently qualified.

A point has been reached in the feeding studies where further knowledge of the physiology of nutrition is indispensable if progress is to be made in working out the laws which underlie practice. The more superficial work has been done. The composition and digestibility of all the principal feeding stuffs have been determined, as well as their general effects when fed. The practical feeder has been overtaken and his empirical rules largely mastered. But to build up a science of

feeding requires a more thorough understanding of the fundamentals of animal nutrition, the relations of supply to demand in animal economy and between cause and effect.

There is a feeling that the limit of scientific advancement in feeding by the ordinary methods of investigation has about been reached. Many experimenters, realizing the weakness of their present position, are making feeding work a less prominent feature than formerly. We are ready for the more fundamental work, and the need of it is far more widely felt than it was a few years ago. The real problems of feeding and nutrition are felt to be very intricate, far too much so for the experimenter without special training and equipment. They demand the undivided attention of specialists, with a reasonable assurance of continued support for a term of years.

Little advancement in scientific cheese making was made until the nature of the changes, the causes operative, and the effect of conditions on the development of these causes had been found out. Then a sound, intelligent basis for action was at hand. The same applies to the feeding question, although there the problem is even more complex and individuality will always have to be taken into account.

With the sentiment which has developed in recent years there should be abundant support for this higher research work in animal nutrition. The problems presented are national ones in their breadth of interest and importance, and hence the participation of the General Government in carrying on the investigations seems particularly fitting and desirable. Having devised and built in this country an apparatus which is regarded as a model for this character of investigation, it is greatly to be desired that opportunity be afforded for utilizing it to the fullest extent and getting the most possible out of it.

From every point of view, therefore, the action of the Pennsylvania board of trustees in setting this work off by itself and indicating a policy of fostering it by liberal appropriations seems worthy of special commendation. Investigation of this high order lends solidity to the station work in animal husbandry, and by reflection affects the standing of the work as a whole.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

On the formation of ammonia from the elements, F. HABER and G. VAN OORDT (*Ztschr. Anorgan. Chem., 44 (1905), No. 4, pp. 341–378, figs 3; abs. in Chem. Ztg., 29 (1905), No. 46, Repert. No. 12, p. 162*).—The ammonia equilibrium at various temperatures up to 1,020° C. was restudied.[a]

The ammonia content of a mixture of nitrogen, hydrogen, and ammonia in equilibrium under a pressure of one temperature was found to be 98.51 per cent at 27° C., 8.72 per cent at 327° C., 0.21 per cent at 627° C., 0.024 per cent at 927° C., and 0.012 per cent at 1,020° C. It is claimed that the reversible reaction $Ca_3N_2 + 3H_2 \rightleftarrows 3CaH_2 + N_2$ takes place readily at red heat in connection with the reaction $N_2 + 3H_2 = 2NH_3$. Calcium compounds of nitrogen assist in synthesis of ammonia at such high temperatures as to make their use impracticable. Manganese may possibly prove of value as a catalyser in such reactions, although the high temperatures required with this substance, as with calcium compounds, render its use of doubtful practicability.

The direct synthesis of ammonia, E. P. PERMAN (*Proc. Roy. Soc. [London], Ser. A, 76 (1905), No. A 508, pp. 167–174*).—This article records the results of attempts to synthesize ammonia with a view to determining whether there is a state of equilibrium between ammonia and its constituent elements at various temperatures ranging as high as 1,100° C. The experiments were conducted with carefully dried and purified mixtures of nitrogen and hydrogen prepared (1) by decomposing ammonia in red-hot iron tubes, and (2) by mixing 1 volume of nitrogen obtained by heating ammonium chlorid and sodium nitrite and 3 volumes of hydrogen obtained by action of potash solution on metallic aluminum.

The influence not only of different degrees of temperature but also of the presence of various catalyzing agents was studied. Comparative studies of synthesis by explosion and by electric discharges were also made.

The author concludes from the results obtained that ammonia can not be synthesized by heat except under certain special conditions. He therefore regards the decomposition of ammonia by heat as an irreversible reaction.

He shows that "ammonia may be synthesized in small quantities from its constituent elements (*a*) by heating with many of the metals, (*b*) by exploding with oxygen, (*c*) by sparking. These are reversible reactions.

"It would appear that the synthesis of ammonia is effected only when the gases are ionized; the ionization would be brought about by sparking, or by the high temperature of the explosion of hydrogen and oxygen. The immediate decomposition of the ammonia formed would be prevented by its sudden cooling. The metals in the presence of moisture also produce 'nascent' or ionized hydrogen.

"It does not appear that nitrids of the metals form an intermediate stage in the formation of ammonia, for it was found that metals readily forming nitrids, e. g., magnesium, did not produce more ammonia than the others.

[a] For account of previous studies see Ztschr. Anorgan. Chem., 43 (1905), p. 111.

"There is a close analogy between ozone and ammonia with regard to their synthesis and decomposition; both are formed by sparking, and both are completely decomposed by heat."

The author criticizes the attempt of Haber and van Oordt, noted above, to fix the dissociation constant of ammonia at different temperatures as based upon entirely insufficient data.

On the formation of ammonia from the elements, F. HABER and G. VAN OORDT (*Ztschr. Anorgan. Chem., 47 (1905), No. 1, pp. 42–44*).—This is a defense of the authors' investigations on this subject against the criticism of Perman, noted above. It is also pointed out that Perman's article is not clear as to the part played by vapor of water in the synthesis of ammonia by heat.

The action of nitrogen on water vapor at high temperatures, O. F. TOWER (*Jour. Amer. Chem. Soc., 27 (1905), No. 10, pp. 1209–1216*).—Studies are reported of the rate and extent to which nitrogen combines with the oxygen of water vapor at high temperatures. The amounts of nitric acid which were formed in the experiments reported were very small, and it is shown that theoretically only 0.33 per cent of a gaseous mixture of 3 parts nitrogen and 1 part water vapor can be expected to be converted into nitric oxid at a temperature of 2,000° C. and 1.5 per cent at a temperature of 3,000° C.

The action of nitrogen on water vapor, O. F. TOWER (*Ber. Deut. Chem. Gesell., 38 (1905), No. 12, pp. 2945–2952*).—Noted above from another source.

Nitric acid from air, H. R. CARVETH and C. L. RAND (*Sibley Jour. Engin., 1905, May; abs. in Engin. and Min. Jour., 80 (1905), No. 11, p. 485*).—The authors review the various processes which have been devised for the production of nitric acid by electrical discharges through air, and give a table showing the approximate yields obtained by various experimenters as follows:

Nitric acid produced by different electrical methods.

Date.	Experimenter.	Nitric acid per kilowatt hour.
		Grams.
1897..	Rayleigh	49.1
1900..	McDougal and Howles (best yield)	33.8
1902..	Kowalski	55.0
1903..	Muthmann and Hofer	70.0
1897..	Crookes	74.0
1902..	Bradley and Lovejoy	83.0
1904..	Birkeland and Eyde	110.0

It is thought that these results "indicate that commercial success may yet be attained. The main improvements which may possibly have an advantageous influence on the yield of nitric acid by the electric flame are: (*a*) A vessel so designed as to produce the best hot-cold effect; (*b*) spark long drawn out; (*c*) low current and rapid alternations; (*d*) increased pressure; (*e*) rapid passage of gases and the introduction of the gases in the correct proportions; (*f*) temperature below 1,200° C."

It is considered probable, however, that indirect methods, such as the nitrid or cyanid process, may be found to be more economical.

On the oxidation of the nitrogen of the air by means of electrical discharges, F. VON LEPEL (*Ber. Deut. Chem. Gesell., 38 (1905), No. 11, pp. 2524–2533, figs. 2*).—This is a continuation of previous investigations (E. S. R., 15, p. [illegible]) in which the author describes apparatus and results obtained in experiments in which [illegible] oxidation was observed in case of electrodes rotating in opposite directions. The effect of previous warming of the air and of altering the form of the apparatus was also studied.

Oxidation of atmospheric nitrogen in the high tension arc, A. STAVENHAGEN (*Ber. Deut. Chem. Gesell.*, *38* (*1905*), *No. 9, pp. 2171–2177; abs. in Jour. Chem. Soc.* [*London*], *88* (*1905*), *No. 514, II, p. 517*).—"Air was forced at known rates through a cooled porcelain tube containing two iron electrodes; the tension was about 20,000 volts and the current 0.07 ampere, the discharge being a continuous greenish-yellow flame. Large quantities of oxids of nitrogen were formed, the yield being a maximum when air was forced through at a velocity of 180 liters per hour. It is impossible to completely condense all the oxids of nitrogen formed in this manner even by means of liquid air."

The examination of cyanamid and applications of the method, R. PEROTTI (*Gaz. Chim. Ital.*, *35* (*1905*), *II, pp. 228–232; abs. in Chem. Centbl.*, *1905, II, No. 14, p. 1053*).—It is stated that cyanamid reacts with silver nitrate in presence of ammonia to form silver cyanamid and nitric acid, 1 cc. of hundredth-normal silver solution corresponding to 0.00021 gm. cyanamid.

To the silver nitrate made slightly alkaline with ammonia add the cyanamid solution drop by drop with shaking and gentle warming. Filter after the solution has cleared and wash the precipitate with weak ammonia, add 3 or 4 drops of iron alum and nitric acid to the filtrate, and titrate with hundredth-normal rhodan-ammonium. The method is applicable to commercial calcium cyanamid (lime nitrogen), the solution of the material to be tested being obtained by 12 hours' standing in the cold and each cubic centimeter of hundredth-normal silver nitrate used, corresponding to 0.0004 gm. calcium cyanamid.

Expulsion of ammonium salts after precipitation in their presence, P. JANNASCH (*Jour. Prakt. Chem.*, *n. ser.*, *72* (*1905*), *No. 13, p. 38; abs. in Jour. Chem. Soc.* [*London*], *88* (*1905*), *No. 515, II, p. 611*).—"Large quantities of ammonium chlorid are expelled from solutions by evaporation with concentrated nitric acid containing nitrous acid."

The true atomic weight of nitrogen, G. D. HINRICHS (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 24, pp. 1590, 1591*).—Evidence is cited to show that the atomic weight of nitrogen is exactly 14.

A revision of the atomic weight of potassium, E. H. ARCHIBALD (*Proc. and Trans. Roy. Soc. Canada, 2. ser.*, *10* (*1904*), *Sec. III, pp. 47–53, fig. 1*).—A series of studies of the atomic weight of potassium based upon analysis of potassium chlorid is reported, the average results giving an atomic weight for this element of 39.14.

On the determination of assimilable phosphoric acid in soil, A. S. KUDASHEV (*Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6* (*1905*), *No. 4, pp. 437–456*).—The author recommends ½ per cent oxalic acid as a reagent for determining the assimilable phosphoric acid in soils and reports tests of the reagent on 62 samples of chernozem soil. In all cases the more fertile soils yielded the larger amount of phosphoric acid soluble in the reagent. Soils treated with manure were also found to contain more phosphoric acid soluble in the reagent than untreated soils.—P. FIREMAN.

Action of phosphates on platinum when heated with it in the presence of carbon, W. P. HEADDEN (*Proc. Colo. Sci. Soc.*, *8* (*1905*), *pp. 45–49; abs. in Jour. Amer. Chem. Soc.*, *27* (*1905*), *No. 11, Rev., p. 615*).—The deterioration of platinum crucibles when repeatedly used for the ignition of ammonium-magnesium phosphate is explained as due to the formation of platinum phosphid.

A study of various methods for the determination of aluminum in the ash of plants, H. PELLET and C. FRIBOURG (*Ann. Chim. Analyt.*, *10* (*1905*), *No. 10, pp. 376–381*).—Tests of the methods of Carnot, Lasne (E. S. R., 7, p. 915), and Sainte-Claire-Deville, as modified by L'Hôte, are reported. As a result of these tests the author prefers the method of Carnot, although he considers that of Lasne equally good but somewhat longer.

A method for the determination of carbonates in soils, A. AMOS (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 322–326, fig. 1*).—The author reports the successful use on soils containing very small amounts of calcium carbonate of a form of Brown and Escombe's modification of Hart's method. This is based on absorption of the carbon dioxid driven off from the soil sample (by boiling with hydrochloric acid) in a 4 per cent solution of sodium hydroxid in a Reiset absorption apparatus, and double titration, first with phenolphthalein and then with methyl orange as indicator, of the mixed solution of sodium hydroxid and sodium carbonate obtained.

Contribution to chemical methods of water examination, A. BÖMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), pp. 129–143; abs. in Chem. Centbl., 1905, II, No. 10, pp. 788, 789*).—This article discusses the results of examinations of various samples of water from moors, wells, and springs, especially with reference to their suitability to domestic and industrial purposes.

Some points about water analysis, C. D. HOWARD (*N. H. Sanit. Bul., 2 (1905), No. 9, pp. 145–148*).—A brief discussion of the value of analysis for judging of the sanitary condition of waters and of the sources and means of prevention of contamination of the water supply.

A modification of Winkler's method of determining oxygen in water, H. NOLL (*Ztschr. Angew. Chem., 18 (1905), No. 45, pp. 1767, 1768*).—The essential feature of the modification is the reversal of the order of addition of manganous chlorid and potassium iodid, the addition of the iodid following that of the chlorid in the Noll modification instead of preceding, as in Winkler's original method. It is claimed that in this way more accurate results are obtained.

Note on the report of the work of the international committee for the analysis of commercial fertilizers and feeding stuffs to the Fifth International Congress of Applied Chemistry at Berlin, 1903, T. B. WOOD (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 366–373*).—The history of the work of this committee is briefly outlined and the recommendations which were presented and unanimously accepted at the Berlin congress are given

Chemical analysis of feeding stuffs and its relation to feeding experiments, V. STORCH (*Ber. K. Vet. og Landbohojskoles Lab. Landokonom. Forsog [Copenhagen], 58 (1905), pp. 180, charts 8*).—The author gives an historical sketch of the development of the analysis of feeding stuffs and the various methods by which attempts have been made since Thaer's time to determine feeding value. He also presents a critique of the so-called Weende methods of analysis, and explains in detail the methods employed in the analysis of feeding stuffs by the chemical department of the Copenhagen Experiment Station.

The faults of the conventional methods of determining nitrogenous components, cellulose (crude fiber), and nitrogen-free extract are discussed at length and available data summarized. The author recommends that albuminoid nitrogen be determined instead of total nitrogen. Since the variations in the nitrogen content of the various nonalbuminoid components in plants and feeding stuffs are so great as to preclude the adoption of any single conversion factor, he advocates doing away with the factor 6.25 for conversion of albuminoid nitrogen to albuminoids, and, on the basis of the results of the investigations of Ritt[illegible], [illegible]nden, and Osborne, suggests that the factors 6.0, 5.7, and 5.5 be adopted for substances of different origin, as follows: For corn, oats, buckwheat, white beans, soja beans, rape [illegible] cakes, potatoes, mangolds, hay and straw, the factor 6.0. For wheat, rye, barle[illegible]heat bran, rye bran, peas, horse beans, vetches, sesame ca[illegible] and candlenut ca[illegible] the factor 5.7; and for peanut cake, cottonseed cake, sunflower seed cake, linseed [illegible] hempseed cake, almond cake, cocoanut cake, and Brazil nut cake, the factor [illegible]

The various methods proposed for the determination of cellulose (crude [illegible] considered at length, comparative results being given. According to the [illegible] [illegible]isfactory method for determining this constituent is available as yet [illegible] rec-

ommends that it be determined by difference. The fact is recognized that the errors introduced in the proposed methods of determining protein and cellulose affect the figures for nitrogen-free extract, as well as the calculated nutritive ratios.

In general the author recommends that the following components of feeding stuffs be determined, viz, fat, albuminoids, sugar, starch, pentosans, ash, and water, with cellulose and other nondeterminable substances grouped by difference. This scheme of analysis has been in use in the chemical department of the Copenhagen station during recent years. A number of analyses made by the proposed methods are given. The bearing of these methods of analysis on digestion coefficients is discussed.—F. W. WOLL.

Methods of estimating fat, G. ROSENFELD (*Centbl. Inn. Med., 1905, No. 14; abs. in Biochem. Centbl., 3 (1905), No. 23, pp. 739, 740*).—The author concludes, from a study of different methods, that twice boiling with alcohol for a quarter of an hour and extracting 6 hours with chloroform is the most satisfactory method of estimating fat, both as regards the quantity extracted and its freedom from nitrogen.

The determination of fat and water in butter by the Gerber method, A. HESSE (*Milchw. Zentbl., 1 (1905), No. 10, pp. 433-444*).—The Gerber methods for the rapid determination of fat and water in butter were tested and found, according to the author, to be unsuitable for both control work and purposes of investigation.

Tests of Sichler's "sin-acid" butyrometry, LOTTERHOS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 10, pp. 596-599*).—Comparative determinations by the Sichler and gravimetric methods were made on milk, skim milk, buttermilk, curdled milk, milk preserved with potassium bichromate, formaldehyde, and copper sulphate, and cream. The author concludes that the Sichler nonacid method in its present form is of equal value to the Gerber acid method.

The determination of the fat content of butter by the method of Gottlieb, A. BURR (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 5, pp. 286-290*).—The author considers the Gottlieb method of determining fat in milk applicable, with more or less modifications, to all forms of dairy products.

On the examination of curdled milk, VON WISSELL (*Milchw. Zentbl., 1. (1905), No. 9, pp. 401-417*).—Determinations of fat, total solids, and specific gravity were made on sweet and curdled milk with and without previous treatment with ammonia.

The results for fat by the gravimetric method and the methods of Gottlieb and Gerber showed practically no influence due to the souring of the milk or the addition of ammonia. Curdled milk rendered fluid by the addition of ammonia showed, however, too low a percentage of total solids and too high a specific gravity. It is believed that these determinations may be corrected by adding 0.44 to the former and deducting 0.001 from the latter.

Contribution to the knowledge of sesame oil, H. SPRINKMEYER and H. WAGNER (*Ztschr Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 6, pp. 347-353*).—Analyses were made of samples of sesame oil from India, the Levant, and Africa. No marked differences in chemical or physical properties were observed in the case of samples from the first two sources. The African oil showed higher iodin and refractometer numbers. A modification of the Baudouin test for the detection of sesame oil in butter is described.

The guaiac reaction of milk, A. ARNOST (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, pp. 538-540*).—The results of the author's investigations confirm those of [illegible]mann-Wender and of Liebermann that the guaiac solution used in distinguishing raw from cooked milk becomes active after exposure to light and air, and also the observation of Zink that the acetone solution gives a reaction even in a fresh condition.

The use of fermentation methods in the laboratory; a contribution to the study of starch sirups, VON RAUMER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905),*

No. 12, pp. 705–726).—Different commercial yeasts and pure cultures were studied with special reference to the examination of sirups. In the author's opinion, since pure cultures can not always be obtained in all laboratories, beer yeast may be used and will give satisfactory results in the estimation of dextrin. When it is desirable to determine maltose in addition to glucose and dextrin, wine yeast may be used.

A new indirect method of determining aldehyde in lemon oil, E. BERTÉ (*Chem. Ztg., 29 (1905), No. 60, pp. 805, 806*).—The method depends upon the differences noted with the polariscope in liquid lemon oil before and after it has been acted upon by potassium bisulphite, as in the method previously described by Berté and Soldaini.[a]

The estimation of the fusel oil of alcoholic liquors, E. BECKMANN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1–2, pp. 143–152*).—Improved methods of estimating fusel oil are described.

Contribution to our knowledge of the action of pepsin, with special reference to its quantitative estimation, P. W. COBB (*Amer. Jour. Physiol., 13 (1905), No. 5, pp. 448–463, figs. 3*).—A study of the comparative merits of different methods for the quantitative estimation of pepsin is reported. Some of the conclusions which were drawn follow:

"Making all due allowances for errors due to the [Metts] method itself, pepsin solutions capable of digesting 4 mm. or over in 24 hours give results far below those anticipated by the rule of square roots from the amount of pepsin present. No calculation can be made in any case as to the absolute or relative pepsin values until the question of inhibition is eliminated. Commercial pepsin sometimes contains considerable amounts of inhibitory substance, evident in solutions of $\frac{1}{64}$ per cent strength. And in regard to the albumin-froth method of Bettman and Schroeder: Results obtained by it can not be justifiably expressed in figures indicative of pepsin-concentration, but only by such expressions as 'strong,' 'very strong,' 'moderate,' etc."

The estimation of boric acid, W. VAUBEL and E. BARTELT (*Chem. Ztg., 29 (1905), No. 46, pp. 629, 630*).—The detection of boric acid with curcuma paper and its estimation by the Jörgensen titration method are discussed on the basis of personal experience.

Among other precautions the authors note that the Jörgensen method does not give satisfactory results when phosphoric acid is present and that sulphurous acid must be removed before the method can be applied. Any strong acid other than boric should be neutralized, and when this is done methyl orange may be used as an indicator.

Modification of Hehner's test for formaldehyde, A. B. LYONS (*Pharm. Jour. [London], 75 (1905), p. 443; abs. in Jour. Soc. Chem. Indus., 24 (1905), No. 20, p. 1086*).—In using Hehner's test for the detection of formaldehyde in other solutions than milk, the author recommends the addition of beef peptone instead of milk and states that this test is capable of detecting 1 part of formaldehyde in 4,000,000.

Strychnin tannate and its use in the analysis of tanning materials, S. R. TROTMAN and J. E. HACKFORD (*Jour. Soc. Chem. Indus., 24 (1905), No. 21, pp. 1096–1100, fig. 1*).—Objections to the hide powder method and the collin method of Parker and Payne for tanning materials are pointed out, and a method based upon the precipitation of tannic acid with strychnin sulphate is described.

The use of the electric current in quantitative determinations in food analysis, G. RUPP (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1–2, pp. 37–41*).—A paper with discussion presented before the meeting of German Food Chemists in Dresden, 1905. The method proposed depends upon the resistance of different liquids to the passage of an electric current.

[a] Chem. and Drug., 1903, Sept.

Outlines of physiological chemistry, S. P. BEEBE and B. H. BUXTON (*New York and London: The Macmillan Co., 1904, pp. VIII+195, figs. 3, dgms. 4*).—Theoretical questions connected with physiological chemistry are discussed in this volume, special attention being paid to chemical formulas and reactions. Some of the chapters deal with the following topics: Theory of solutions, ionization; chemistry of carbon compounds, cyclic compounds, proteids, enzyms, and disease and immunity.

Studies and observations of agricultural chemical experiment stations in continental Europe, H. G. SÖDERBAUM (*Meddel. K. Landtbr. Styr. [Stockholm], 1905, No. 102, pp. 52*).—The observations refer to the following stations visited by the author: Berlin, Halle, Leipsic, Möckern, Dresden, Pommritz, Prague, Vienna, Kronenburg, Leopoldskron, Munich, Hohenheim, Nancy, Paris, Gembloux, Wageningen, Groningen, Bremen, Kiel, and Copenhagen.

METEOROLOGY—WATER.

Report of Interstate Astronomical and Meteorological Conference, Adelaide, May, 1905 (*Adelaide: C. E. Bristow, 1905; rev. in Nature [London], 73 (1905), No. 1879, p. 8*).—This report, prepared in view of the possible reorganization of the astronomical and meteorological service under the federal government of Australia, describes briefly present arrangements for such work in the several colonies of the commonwealth.

It also outlines a plan for future observations, based upon "the idea of the establishment of a central federal institution for theoretical and scientific meteorology, 'where the observations for the whole of Australia should be collected, discussed, and published, and where all the higher problems of meteorological science may be investigated; but such institution should have nothing to do with the daily weather service and issue of forecasts.' Duties connected with the latter services, according to the scheme, are to be entrusted to an official in each state."

Report on the climate and weather of Baltimore and vicinity, O. L. FASSIG (*Md. Weather Serv. Spec. Pub., 2 (1905), pt. 1b, pp. 145–310, pls. 12, figs. 47*).—This is a second section of the report on this subject (E. S. R., 16, p. 1058) and completes the part dealing with climate. The second part of the report is to deal with the weather of Baltimore and its vicinity.

Data based on observations by the U. S. Weather Bureau and U. S. Army Medical Department on humidity, precipitation, sunshine and cloudiness, winds, and electrical phenomena are summarized. Diurnal, annual, and irregular variations are considered. The general character of the season is shown graphically by a series of diagrams, "in which eight selected factors, expressed as departures from the normal climatic conditions at Baltimore, are presented for each season and year from 1871 to 1904." A brief account is given of the instrumental equipment and the history of observations of the Maryland Weather Service.

The mean precipitation for 1871–1903 was 43.34 in., the heaviest monthly rainfall being in July and August (4.66 and 4.20 in., respectively) and the lowest in October and November (2.99 in.). The average number of rainy days was 131. The heaviest rainfall occurs in spring and summer, the lightest in fall and winter.

Meteorology [of Tunis], winter of 1904–5, G. GINESTOUS (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 35, pp. 304–315*).—A summary of observations on pressure, temperature, rainfall, evaporation, humidity, etc., at a large number of stations in different parts of Tunis.

On the cyclonic distribution of rainfall, J. A. UDDEN (*Augustana Libr. Pubs., No. 4, pp. 21, figs. 10*).—A series of observations on the occurrence of precipitation or cloudiness at Davenport, Iowa, with reference to the position of the center of the cyclonic area at the time of the observations is recorded and discussed, and results are platted on charts.

It was found that precipitation was most frequent at this point when it was to the west of the central low and most infrequent when it was to the southeast of the center. "From this distribution of precipitation it is evident that if forecasts were made on the supposition that precipitation is greatest on the southeast side of the central low, a large percentage of the predictions would announce the stormy weather ahead of time. For it would often happen that the center of the low would have to move east some two or three hundred miles before it would bring up that tract, where rains and snow are actually most frequent."

A similar study of data for other regions of the United States (the southwest plains, the Northwest, the upper Missouri valley, and Detroit and Buffalo) shows "clearly that the area of the greatest rain and snowfall is not in the same position with regard to the centers of low areas in different climatic regions. In every case it is eccentric and lies to the west, northwest, north or northeast, in the cases studied, but in no instance to the southeast."

The influence of eclipses on the movement of the atmosphere, W. DE FONVIELLE and P. BORDÉ (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 13, pp. 901, 902*).—Discusses Clayton's work on this subject published in Memoirs of Harvard College, Vol. XLIII.

The pioneer forecasters of hurricanes, W. M. DRUM (*Havana, Cuba: Observatory of Belén, 1905, pp. 29*).—A brief review of the meteorological work of the Observatory of Belén in Havana, especially with reference to the forecasting of hurricanes in which, it is claimed, this institution was the pioneer.

Lunar influences, C. FLAMMARION (*Bul. Mens. Off. Renseig. Agr. [Paris], 4 (1905), No. 8, pp. 948–950*).—The results with peas, beans, beets, carrots, leeks, onions, potatoes, and other vegetables planted in different phases of the moon were inconclusive as to the influence of lunar radiation on vegetation. The observations are to be continued through a series of years.

On the influence of climatic factors on the development of plants, V. IVANOV (*Zhur. Opuitn. Agron. [Russ. Jour. Expt. Landw.], 6 (1905), No. 1, pp. 11–23*).—The author points out that in interpreting the results of their studies on the influence of any climatic factor (light, heat, or humidity) on the yield, investigators as a rule base their conclusions on a comparison of the curves of the changes of the factor under consideration with the curves of the changes in yields, the remaining factors being ignored. Such a method can hardly be considered as scientific and does not give positive results.

The author describes a method which, in his opinion, is more reliable. This is based upon a consideration of observations on all climatic factors—mean temperature, precipitation, humidity of the air, soil moisture, hours of sunshine, etc.—during a number of years, compared with the total yields for the same period, as well as the increase in weight of the plants during certain intervals of time. It is also of importance to know the normal rates of increase of weight of plants at different stages of growth under controlled conditions as determined in laboratory experiments.—P. FIREMAN.

Investigations on the chemical composition of atmospheric precipitation as dependent upon meteorological factors, A. POSNJAKOW (*Zhur. Opuitn. Agron. [Russ. Jour. Expt. Landw.], 5 (1904), No. 6, pp. 740–788; abs. in Centbl. Agr. Chem., 34 (1905), No. 5, pp. 289, 290*).—Systematic studies of the chemical composition (nitrous acid, nitric acid, ammonia, and sodium chlorid) of atmospheric precipitation, made at the magnetic-meteorological observatory of the University of Odessa during the period from April 1 to December 31, 1903, are reported.

The investigations included also studies of the influence of the direction and velocity of the wind on the frequency, amount, and composition of the rain, snow, dew, frost, etc. Dews were most frequent preceding a rainy period, but the heaviest dews followed such periods. The larger proportion of the dews occurred when the

velocity of the wind was from 4 to 5 meters per second, although the heaviest dew was observed when the velocity of the wind was from 5 to 6 meters per second. The average chlorin content of the precipitation was 17.9 mg. per liter, of ammonia 0.9 mg. per liter, nitric acid 0.8 mg. per liter.

The content of nitric acid as well as ammonia declined as the length of the rainy period increased. Thunderstorms exerted no influence on the composition of the precipitation. The ammonia content was higher after periods of drought. Precipitation which occurred during a sea wind contained the smallest amounts of ammonia and nitric acid; that which occurred during a wind from the direction of the town contained the largest amounts. The highest ammonia content was observed with a wind velocity of 46 meters per second; the maximum nitric acid content with a velocity of 3 to 5 meters per second.

Dew, frost, etc., contained nearly 2½ times as much ammonia, a correspondingly smaller amount of nitric acid, and a relatively larger amount of chlorin than rain, snow, etc. They also almost always contained some nitrous acid. The variations in the ammonia content of dew, frost, etc., depending upon the direction of the wind, were similar in character to those observed in case of rain, snow, etc., and as in the case of the latter, the composition of the dew, frost, etc., was not affected by thunderstorms. An increase in the velocity of the wind during precipitation resulted in a lowering of the ammonia content.

It is estimated that during the whole period of observation the precipitation carried down to the soil 1.22 lbs. of combined nitrogen per acre. The precipitation richest in nitrogen occurred during the warmest months, July and August.

The amounts of nitrogen as ammonia and as nitric acid, and of chlorin in the rain water collected at Rothamsted, N. H. J. MILLER (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 280-303*).—This is a detailed summary and discussion of data relating to this subject, which have been more briefly reported elsewhere (E. S. R., 16, p. 856). In addition to the full tabulated data, a bibliography of 125 references to literature relating to the composition of atmospheric precipitations is given.

Nitrous acid in sea water, E. BÖDTKER (*Chem. Ztg., 29 (1905), No. 73, p. 956*).—Determinations by means of the Natterer iodin-zinc-starch solution or Greiss's reagent showed 0.002 to 0.01 mg. of nitrous acid (N_2O_3) per liter of sea water taken at Dröbak Biological Station on Christiania Fiord. This is about as much as the author found in rain water and makes it questionable whether nitrous acid generally plays any part in the nitrogen absorption of sea plants.

Neolithic dew ponds and cattle ways, A. J. and G. HUBBARD (*New York: D. Van Nostrand Co., 1905, pp. XII+70, figs. 25*).—This book is interesting as showing how a primitive people solved the problem of securing a water supply in their hill settlements where springs and streams were not available. The thermodynamics of the dew ponds, which condensed and collected the moisture of the air, is explained.

Recent progress in matters of water supply and sewage disposal, G. W. FULLER (*Jour. Amer. Med. Assoc., 45 (1905), No. 15, pp. 1059-1065*).—A paper read in the section on hygiene and sanitary science of the American Medical Association, at the fifty-sixth annual session, July, 1905, discussing the use of copper sulphate for purification of water supplies and reviewing progress in purification of water by sedimentation, filtration, etc., in water-supply control, and in disposal of sewage (by dilution, filtration, and septic treatment). The sewage pollution of oysters and other shellfish is also referred to.

A contribution to the study of the purification of waste waters of towns and of industries, A. CALMETTE, E. BOULLANGER, and E. ROLANTS (*Ann. Inst. Pasteur, 19 (1905), No. 9, pp. 529-540*).—The methods used and results obtained in a series of studies of the rate of destruction of the organic impurities of sewage by anaerobic fermentation in septic tanks are reported.

It was found that about half of the carbon of the sewage disappeared during 14 days, part in form of gas and part deposited in insoluble form. During the same period about 64 per cent of the organic nitrogen disappeared, but the amount of ammoniacal nitrogen increased, the total loss of nitrogen being about 8 per cent. A study of the relative rate of decomposition of the solid matter of the sewage in covered and uncovered tanks showed very slight differences as regards the efficiency of aerobic and anaerobic fermentation in dissolving the solid matter.

SOILS—FERTILIZERS.

The gist of four years' soil investigation in the Illinois wheat belt, C. G. Hopkins, J. H. Pettit, and J. E. Readhimer (*Illinois Sta. Circ. 99, pp. 4*).—The sources of supply of nitrogen, potassium, and phosphorus for wheat crops grown on the soils of this region are described, and the results of 4 years' experiments with different fertilizers, showing a profit only in case of applications of commercial phosphates, are briefly summarized.

The gist of four years' soil investigation in the Illinois corn belt, C. G. Hopkins, J. H. Pettit, and J. E. Readhimer (*Illinois Sta. Circ. 100, pp. 4*).—The sources of supply of nitrogen, potassium, and phosphorus for corn crops grown on the soils of this region are described, and the results of 4 years' experiments with different fertilizers, showing a profit only in case of applications of commercial phosphates, are briefly summarized.

Contribution to the solution of the question of the water content of the soil and the water requirements of plants, C. von Seelhorst and Müther (*Jour. Landw., 53 (1905), No. 3, pp. 239–259*).—This is an account of a continuation during 1904 of similar work carried on in previous years (E. S. R., 16, p. 856) and records results of observations on soils under oats, clover, and bare fallow in large cylinders (1½ cubic meters contents) sunk in a trench and so arranged that they can be weighed at regular intervals. In case of the oats the surface soil of one cylinder was kept stirred between the rows, while that of a second cylinder was compressed by rolling.

A detailed record is given of the rainfall, the hours of sunshine, and temperature of the air and soil, as well as of the changes in weight of the cylinders. The total rainfall during the period of growth of the oats was 109.8 mm. Of this, all was evaporated except 20.8 mm. in the case of the cultivated soil and 30.4 mm. in the case of the rolled soil. Of the 67.9 mm. of rainfall received by the clover up to the time of the first cutting, 47.2 mm. was evaporated.

The water requirements of both oats and clover were very much in excess of that supplied by rainfall during the growing season, hence the water supply of the soil derived from previous winter rains was drawn on. In case of oats grown on cultivated soil, 1 gm. of dry matter required 256.7 gm. of water, on rolled soil 270.2 gm. While the absolute amount of water required in case of oats grown on rolled soil was smaller than that of oats grown on cultivated soil, the relative amount was larger, due to the smaller yield on the rolled soil.

This lower yield on rolled soil is ascribed to poorer aeration, resulting in slower transformation of plant food and interference with root transpiration and not to lack of water. One gram of dry matter in the first cutting of clover required 423 gm. of water, in the second cutting 1,124 gm. There was very little drainage water in case of the cropped soils, and the loss of nitrogen in this way was very small, 6 kg. per hectare (5.34 lbs. per acre) under oats and 11.8 kg. per hectare (10.51 lbs. per acre) under clover. The amount of drainage water from the bare soil was much larger and the loss of nitrogen in this way was 60 kg. per hectare (53.44 lbs. per acre).

The hygroscopic capacity of soils, C. M. Luxmoore (*Jour. Agr. Sci., 1 (1905), p. 3, pp. 304–321*).—This article reports laboratory studies of the capacity of soils to

retain moisture in equilibrium with the atmosphere as influenced by proportion and character of organic material, relative proportions of mineral particles of different sizes, chemical and physical nature of mineral constituents, and temperature and humidity of the atmosphere. The studies were made with fine earth passing a sieve with meshes 3 mm. in diameter.

A mathematical exposition is given of the bearing of the analytical data on the first three factors named, and two series of experiments are reported. In the first of these "a number of small weighing bottles were prepared, containing respectively a gram each of five different soils and of their six fractions. These were put under a bell-jar, together with a dish which contained during most of the experiments a solution of calcium chlorid of which the concentration was determined when the bottles were removed for weighing; at the conclusion of the series the dish was filled with granular calcium chlorid in order to obtain the weight of the samples in equilibrium with a dry atmosphere. The water lost at 95° and the loss on ignition were also found, but all results are calculated to the weight of the material dried in this manner in the cold."

In order to overcome irregularities in individual figures observed in the first series, "the second series of experiments was extended over a greater number of observations, and more duplicates were used. The standard weights attained in a cold, dry atmosphere were determined eight times, five times over granular calcium chlorid, and three times over fused caustic potash, and the results obtained were in most cases in satisfactory agreement."

The more important conclusions reached are that "the organic substance not only has a powerful direct influence in attracting moisture, but it also acts indirectly, so that the joint effect of the organic substance and the surface of the mineral particles is not merely an additive property. The organic material probably serves to keep the finer grades of mineral matter apart and free to exercise surface attraction far more effectually than the coarser mineral particles are able to do. It appears that the organic substance in different fractions has not always the same hygroscopic power. . . . Mineral particles of the same size in different soils have not identical hygroscopic power. . . . The finest grade particles, especially the clay fraction, show specially high attraction for water in atmospheres of extreme moistness. . . .

"It follows from the foregoing that the attraction of mineral particles for moisture can not be strictly expressed as simply proportional to their surface, and it is readily seen that many apparent irregularities in the tables are due to the causes [noted above]. But within certain limits as to moisture in the atmosphere, and in spite of the disturbing influence of other factors such as the varying attraction of the organic material, its indirect action, and the special hygroscopic action of iron oxid and perhaps other soluble minerals, there is a regularity in what is here called the moisture multiple, so that it tends to assume a value inversely proportional to the diameter raised to the two-thirds power. . . .

"It appears as if the use of the two-thirds power ratio was most suitable for the majority of cases, but in the case of the finest particles in a very moist atmosphere the increase in moisture gained proceeds at a far higher rate."

The moisture of the soil in the climate of Tunis, F. Bœuf and Tourniéroux (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 35, pp. 286–303, fig. 1, chart 1*).—A large number of determinations of moisture in cultivated and uncultivated soil and during different seasons (rainy and dry) of the year ended June 30, 1904, are summarized.

In the soils studied the moisture varied from 4 to 20 per cent. In soil which had been dug up to a depth of 0.15 meter (5.91 in.) the moisture varied from 8 to 20 per cent, in soil which had been cultivated after removal of the crop of wheat the variation was from 5 to 15 per cent, and in uncultivated soil 5 to 18 per cent. The improvement of the capacity of the soil for storing and retaining water by digging was quite

marked. On the other hand, light cultivation of the surface soil appeared to hasten drying out. The evaporation from the uncultivated soil was about the same as from that lightly cultivated, but it showed the advantage of absorbing more water in winter.

Oxidation in soils and its connection with fertility, E. J. RUSSELL (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 261-279, figs. 2*).—Previous studies by Dehérain, Demoussy, and Wollny on oxidation in soils have been based on measurements of the carbon dioxid produced by soil kept at constant temperature in a given volume of air. The author reports studies based upon measurements of the actual oxygen absorbed.

The apparatus used consisted of "a flask of about 100 cc. capacity with two tubes sealed into its neck. One of these (*A*, fig. 1) is bent at right angles and terminates in a bulb *B;* higher up is the narrower one, *C*, of about 4 mm. diameter, also bent at right angles, but open at the end. A weighed quantity of the air-dried soil is introduced into the flask, a definite amount of water is added, and the neck of the flask is either sealed up or closed with a very well-fitting rubber cork. Potash solution (1 KOH : $2H_2O$) is run into *B* by the little side tube *D*, which is then sealed, and the end of *C* is dipped under mercury, thus converting it into a gage. The apparatus is now placed in a water-bath at constant temperature, oxygen is absorbed, and doubtless a complex reaction takes place, but the only gas likely to be set free from ordinary soils is carbon dioxid, and this is so rapidly absorbed by the potash that at any given moment the quantity present in the first state is negligible.

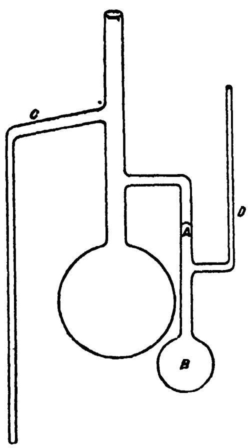

FIG. 1.—Apparatus for measuring the oxidation of soils.

"The absorption of oxygen is indicated by the rise of mercury in *C*, and from a measurement of the height of the column above the surface the amount of oxygen taken up is readily found. A cathetometer and millimeter scale are used for this purpose."

By this means the author studied the relation of various factors, such as quantity of soil, moisture content, lime and calcium carbonate content, horizon of soil (surface soil or subsoil), sterilization, and age of samples to oxidation. The rate of oxidation in a number of soils of known but varying fertility was also investigated.

The significance of the results is somewhat fully discussed and the following conclusions are drawn:

"(1) The rate at which oxygen is absorbed by a soil can be easily and accurately measured by the method here described.

"(2) The rate increases with the temperature, the amount of water (up to a certain point), and the amount of calcium carbonate, and is favored by the conditions obtaining in the surface soil as opposed to those in the subsoil.

"(3) These are also the conditions favoring fertility. It is found that with different soils of the same type the rate of oxidation varies in the same way as the fertility, and may be used to measure it. Pasture soils are at present excluded, however.

"(4) It is suggested that the oxygen absorbed measures the total action of the micro-organisms, which, by producing enzyms and in other ways, hasten decomposition in the soil. Plant food is thus produced, and the general conditions are rendered more favorable for plant life. Ceteris paribus, the more rapid these changes the more productive the soil will be."

On the fixation of ammoniacal nitrogen by zeolites in the soil, T. PFEIFFER and A. EINECKE (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 2, pp. 299-310*).—Experiments were made with barley grown in glass vessels holding about 4,000 gm. of sand to

which was added 100 to 300 gm. of a zeolite prepared by mixing cement, fine-ground silica, and ocher, allowing the mixture to harden under water, grinding to a fine powder, and extracting with calcium chlorid and sodium chlorid solutions and water. The material thus obtained is designated a potassium-sodium-calcium zeolite. Superphosphate and ammonium sulphate were also applied. Data showing the balance of nitrogen in soil, fertilizers, and crops are reported, for soils receiving zeolite and those not so treated. The results indicate that the fixation of nitrogen by the zeolites was greater than the loss of ammonia due to the addition of calcium carbonate.

A new apparatus for the determination of ammonia absorption by soils, WOHLTMANN and P. SCHNEIDER (*Chem. Ztg., 29 (1905), No. 60, pp. 810, 811; abs. in Chem. Centbl., 1905, II, No. 8, p. 650*).—A graduated tube surrounded with a cooling mantle is filled with mercury, the mercury is partly replaced by dry ammonia cooled to 15° C., and a pellet of the soil is introduced into the tube through the mercury at the bottom of the tube. The absorption of ammonia is measured by the change in height of the mercury in the tube. The apparatus used is a modification of that devised by Hilgard for similar purposes.

The direct solution of the silicates of the soil and the experiments of Daubrée, L. CAYEUX (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 11, pp. 509, 510*).—The contention of Delage and Lagatu (E. S. R., 17, p. 226) that the mineral constituents of the soil—feldspars, etc.—are directly dissolved and so made available to plants and are not decomposed is refuted, as is the claim that the work of Daubrée[a] supports such a conclusion.

Agricultural charts, J. GRAFTIAU (*Ann. Gembloux, 15 (1905), Nos. 1 pp. 11–18; 2, pp. 57–63; 4, pp. 196–204; 5, pp. 260–266*).—A discussion of the nature and value of such charts.

Soil fertility, J. B. DANDENO (*Pop. Sci. Mo., 67 (1905), No. 7, pp. 622–625*).—In this article various factors of soil fertility are discussed and an attempt is made to show that soil fertility "is not so much a chemical as it is a physical, bacteriological, and ecological problem."

The microscopic world and agriculture, L. GRANDEAU (*Ann. Sci. Agron., 2. ser. 10 (1905), I, No. 3, pp. 450–473*).—After general notes on micro-organisms, this article discusses the reproduction, multiplication, and nutrition of micro-organisms, the bacterial population of the soil, and nitrification and the nitrifying organisms. The transformation of organic nitrogenous matter first into ammonia, then into nitrites, and finally into nitrates is traced.

Suggestions concerning legume inoculation, L. T. CLARK (*Michigan Sta. Bul. 231, pp. 223–230*).—The history of investigation relating to this subject is briefly reviewed, the practical possibilities of soil inoculation are discussed in a popular way, and methods of preparing pure cultures and studying the inoculating organisms are described.

Experiments on the action of lime nitrogen, E. HASELHOFF (*Landw. Jahrb., 34 (1905), No. 3–4, pp. 597–616, pls. 2*).—The preparation of this material is briefly described and previous experiments to determine its agricultural value are reviewed.

The experiments here reported were made during 1903 and 1904 at the Marburg station, and included investigations on the influence of the lime nitrogen on the germination of seeds and on the fertilizing value of the nitrogen in the material as determined in pot and field experiments. The germination experiments were made with clover and mustard seed in soil and sand to which lime nitrogen was added at the rate of 0.025, 0.05, and 0.1 per cent.

The results obtained were not uniform, but indicated in general an injurious effect of the lime nitrogen on germination, the injury being lessened or entirely prevented in dependence upon the length of time the material was applied before

[a] Étude synthétique de géologie expérimentale, 1879.

planting the seed. The injurious effect was greater in sand than in soil and with mustard seed than with clover seed.

In case of the soil, the addition of 0.05 per cent of lime nitrogen did not injuriously affect either the clover or the mustard seed when they were planted 8 days after the application of the material, while in sand the germination of clover seed was slightly interfered with even when planted 14 days after the application of the lime nitrogen, and when planted at an earlier period germination was entirely prevented. With mustard seed germination was reduced fully one-half even when planting was done 28 days after the application of the lime nitrogen. The same conditions were observed with the larger applications of lime nitrogen, only the injurious effects were more marked.

Pot experiments with mustard on a sandy loam soil to test the relative fertilizing value of lime nitrogen and nitrate of soda, and with carrots to determine the effect of adding lime to the nitrogenous fertilizers, are reported, as well as field experiments with rye and potatoes on light loamy soils and with barley, potatoes, and mangolds on heavier soils.

The general conclusions from the results of these experiments are that while lime nitrogen applied shortly before seeding injuriously affects germination, when the injurious constituents of the matèrial have had time to be transformed in the soil, the nitrogen serves as a plant food and possesses a value very nearly the same as that of the nitrogen of nitrate of soda. The time required for the decomposition of the injurious constituents of the lime nitrogen, however, varies with different kinds of soil, and until definite information on this point has been obtained the author advises that lime nitrogen should be used with caution and on a small scale in practice.

On the effect of ammonium salts on the assimilation of phosphoric acid by higher plants, D. N. Prianishnikov (*Ber. Deut. Bot. Gesell., 23 (1905), No. 1, pp. 8–17*).—The author briefly reviews experiments extending over several years, which show that ammonium salts, especially ammonium sulphate, exert an important influence in rendering the phosphoric acid of mineral phosphates available to higher plants, while sodium nitrate exerts no such influence. For this reason ammonium sulphate is designated "physiologically acid" and sodium nitrate "physiologically alkaline."

A series of sand and water cultures with barley, oats, buckwheat, flax, peas, and vetches to determine the status of ammonium nitrate with reference to acidity or alkalinity as thus defined is reported. The results show that this salt is intermediate in its action between ammonium sulphate and sodium nitrate and indicate that it may under certain conditions be physiologically acid. It was shown to increase the assimilability of the phosphoric acid of insoluble phosphates even in sterile cultures where nitrification did not occur.

Nitrate of soda as a fertilizer, M. Weitz (*Der Chilisalpeter als Düngemittel. Berlin: Paul Parey, 1905, pp. 492, pls. 8, figs. 228*).—This is a very complete treatise by the secretary of the Association of United Nitrate Producers on the occurrence and exploitation of nitrate deposits, the nitrogen requirements of soils and plants, the action of nitrate of soda on different kinds of plants as determined by experiments of various kinds, nitrate of soda as a means of protection against frost, plant diseases and enemies of various kinds, comparative value of nitrate and other forms of nitrogenous fertilizers, recent work on the fixation of the free nitrogen of the air, increasing yields by rational use of commercial fertilizers, the trade in nitrate of soda, and nitrate statistics.

Experiments with Lützeler meat guano, E. Haselhoff (*Landw. Jahrb., 34 (1905), No. 3–4, pp. 642–646*).—This material is a low-grade tankage treated with sulphuric acid and contains on the average 2 to 3 per cent of nitrogen and 1 to 2 per cent of phosphoric acid.

The results of the pot experiments with the guano in comparison with nitrate of soda and sulphate of ammonia indicate that the phosphoric acid is nearly as effective as that of Thomas slag and the nitrogen but slightly less effective than that of ammonium sulphate.

Experiments on the fertilizing value of mixtures of Thomas slag and steamed bone meal with kainit, E. HASELHOFF (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 623-634, pls. 2*).—Pot experiments in 1902 and 1903 with wheat and barley are reported in detail.

Observations on the after-effects of the fertilizers and the influence of lime in connection with the other fertilizer mixtures are also recorded. The results show in general that the addition of kainit increased the effectiveness of the phosphoric acid in the case of both Thomas slag and bone meal. This was due apparently to the action of the kainit in rendering the phosphoric acid more readily available to the plant. The addition of lime in form of carbonate reduced the efficiency of the phosphoric acid in the bone meal to a marked extent.

Experiments on Thomas slag rich in silicic acid, E. HASELHOFF (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 635-637*).—Comparative tests of Thomas slag poor in silicic acid and that in which the silicic acid had been increased by Hoyermann's process showed a somewhat lower efficiency of the latter.

Experiments with steamed Thomas slag, E. HASELHOFF (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 637-641*).—Ground Thomas slag and that which had been reduced to powder by treatment with steam under pressure were tested in pot experiments with barley. The results show no marked difference in effect between the two forms of slag.

Potash salts, M. MAERCKER and M. HOFFMANN (*Die Kalisalze. Berlin: Deut. Landw. Gesell., 1905, 3. ed., pp. VII+61*).—This is the third edition of this treatise intended for the use of practical farmers. The second edition, published about 10 years ago, has been revised and brought up to date in this edition, which is published under the auspices of the fertllizer section of the German Agricultural Society.

On liming, O. LOEW (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 6, pp. 583-602*).—This article reviews quite fully recent investigations, including those of the author and his associates, on the use of lime as a fertilizer, concluding that the results confirm the author's well-known views regarding the necessity of maintaining a definite relation between lime and magnesia in the soil in order to insure the highest productiveness. It is also necessary that neither lime nor magnesia should fall below a certain limit. For this reason it is urged that in soil analysis determinations should always be made of the magnesia as well as of the lime.

Fertilizer suggestions, E. R. FLINT (*Florida Sta. Bul. 81, pp. 365-390*).—The formulas and suggestions contained in this bulletin are compiled from experiments made by the station in Florida and those of neighboring States. The fundamental facts underlying the use of fertilizers are discussed, the raw materials used in preparing fertilizers are described, and formulas for fertilizers for various field crops, fruits, and vegetables commonly grown in Florida are given.

Commercial fertilizers and chemicals, T. G. HUDSON ET AL. (*Bul. Ga. Dept. Agr., 1905, No. 42, pp. 205*).—This is a report on inspection of fertilizers on sale in Georgia during the season of 1904-5, including the text of the fertilizer laws of the State and miscellaneous information regarding fertilizers, as well as statistics by counties of the cotton crop of Georgia, 1900-1904.

Fertilizer analyses, A. J. PATTEN (*Michigan Sta. Bul. 232, pp. 23*).—This bulletin gives the text of the State fertilizer law, a list of dealers in fertilizers in the State, and analyses of 123 samples examined during 1905.

AGRICULTURAL BOTANY.

Experiments showing the effects of mutilation, or cutting, on growth, G. E. Stone (*Massachusetts Sta. Bul. 105, pp. 28–33*).—A series of experiments is reported which show the influence of mutilation of various kinds upon the growth of plants. The experiments were carried on with seedlings of sunflowers, broad beans, and lupines, as evenly paired plants as possible being selected and different lots subjected to mutilation by cutting the primary roots, splitting the primary roots, cutting the secondary roots, etc.

The effect of mutilation on growth, as shown in the experiments, gives some idea of the shock produced by this form of stimulation. The first effect is a disturbance of the normal activities of the plant, which, so far as growth is concerned, is more or less retarded. This is followed by an attempt of the organism to recover. The maximum period of retardation appeared shortly after cutting, and the maximum period of acceleration took place about 24 hours later. The degree of retardation and acceleration appears to be more marked in rapidly growing plants, or those that are more plastic, and is especially marked in the less differentiated cryptogams. In some of the lower organisms the retardation was so brief and the acceleration and growth so rapid that very close intervals in time of measurement were necessary to observe the effects of mutilation.

The experiments have a practical bearing in indicating the effect of pruning secondary organs on the growth of primary ones, and, conversely, the effect of pruning primary organs on the growth of secondary ones. The pruning of primary organs induces a marked stimulus to secondary organs and the pruning of secondary organs induces changes in the growth of primary organs. In the splitting of roots the injuries were of an insignificant character, since none of the essential organs were removed from the plant. By the destruction of the leaders of any terminal organ the normal geotropic irritability was interfered with, and mutilation of this character was sufficient to induce quick and decided responses. The degree of irritability or response to stimulation was more marked in secondary organs when the primary ones were cut, and vice versa.

The author concludes that "mutilation acts as a severe shock and sets the self-regulatory functions of the organism into activity, inducing a series of changes and responses which manifest themselves according to the nature, degree of intensity, and method of applying the stimulus, and they are also dependent upon the nature of the organism stimulated."

The effect of light and Bordeaux mixture on plants, R. Ewert (*Landw. Jahrb., 34 (1905), No. 2, pp. 233–310, pls. 3*).—The author carried on a series of experiments with potatoes to ascertain the effect of light and Bordeaux mixture on the physiological processes of the plant, the investigation being in part designed to test the claim of Schander (E. S. R., 17, p. 451) that the principal beneficial effect of Bordeaux mixture is to be attributed to the protective action that the film of the fungicide exerts on the chlorophyll of the leaf.

After briefly reviewing some recent literature relating to the subject, the author's experiments are described at length. These consisted of growing potatoes in pots under varying conditions of light and shade and with and without applications of fungicides. The effect of the varying degrees of light and of the presence of Bordeaux mixture on the yield of tubers, the starch and water content of the tubers, the foliage, etc., is described. It is said that the cultural and respiration experiments showed that the activity of the plant was reduced in direct proportion to the reduction of the sun's energy when cut off by the Bordeaux mixture.

In the practical use of fungicides the author thinks best not to recommend too complicated mixtures or those which are too expensive. Care should be exercised

in the preparation of Bordeaux mixture not to use iron sulphate in connection with the copper sulphate, as the iron compound not only weakens the solution, but increases its corrosive action. The use of too strong solutions is not to be advised, as they not only injure through their corrosive action, but retard the metabolism of the plant through the shutting off of the sunlight from the tissues of the leaves.

In this connection the author criticises the recommendation of Schander that 4 per cent solutions of Bordeaux mixture should be used on grapevines during bright seasons and weaker ones during cloudy seasons, as it is impossible to foretell what the entire season will be. The use of solutions stronger than those required to prevent fungus attacks is also liable to cause permanent injury to the vines by prolonging their growth late into the period when killing frosts may be expected. A 0.5 to 1 per cent solution of Bordeaux mixture will be found sufficiently strong for most cases.

The action of ether and chloroform on dry seeds, P. Becquerel (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 15, pp. 1049-1052*).—On account of the difference of opinion regarding the action of ether and chloroform on dry seeds, the author has made a study of the subject, in which previous experiments have been repeated and a number of new investigations made.

A study was made of the effect of chloroform and ether in the liquid state. The seeds examined were peas, lupines, clover, alfalfa, and wheat, and they were divided into different lots, in one of which the seed coats remained intact, while in another they were perforated. One lot was in the ordinary condition of stored seed, while other lots were dried over chemicals until there was no further loss in weight. All were placed in chloroform and ether on March 24, 1904, and on March 22, 1905, they were taken from the flasks and spread upon filter paper to allow the liquids and vapors to evaporate.

They were then tested for germination, and the seed of the peas, alfalfa, clover, and lupine, whose seed coats remained intact, germinated after having been 363 days in the chloroform and ether. In all cases where the seed coat had been perforated the seeds lost their germinating power. In addition the wheat, the integument of which is permeable, was similarly affected. It seems that on dry seed, as long as the seed coats remain impermeable, the liquids and vapors of chloroform and ether are without effect.

The transformation of nitrogenous material during the ripening of seeds, G. André (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 21, pp. 1417-1419*).—A study is reported on the changes in the total, albuminoid, and amid nitrogen, etc., of seeds of the white lupine during their ripening.

Vegetable albumin, which is present in the seed, disappears rapidly upon germination. Legumin is also present in the seed, but disappears after germination, reappearing and increasing in amount as the period of ripening advances.

It is shown that the transformation of a nitrogenous material during the ripening of the seed is the inverse of that which takes place during germination. Albumin appears late during the period of ripening and disappears very speedily after the beginning of germination. Legumin makes its appearance earlier during ripening and persists in the ripe seed in larger quantity than albumin.

The reserve carbohydrates of evergreen trees, Leclerc du Sablon (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 24, pp. 1608-1610*).—The author has studied at different times of the year the reserve carbohydrates in the stem and roots of live oak, Austrian pine, and Japanese euonymus.

The carbohydrate content of the roots and stems of the live oak examined are shown in tabular form, and comparisons are made with similar examinations of chestnut stems and roots. In the case of the deciduous tree the maximum reserves were present at the end of October when the leaves were falling, and the minimum took place in the spring when the new shoots were being rapidly developed. In the

case of the live oak the maximum reserve was found in the spring of the year, while the minimum occurred in midsummer.

The Austrian pine gave similar results to those observed for the live oak, its maximum reserve being observed in May, after which there was a sharp reduction to a minimum in July. With the Japanese euonymus, whose growth begins early in the spring, the maximum reserve of carbohydrates was found to be in March, with the minimum in August.

The proteases of plants, II, S. H. VINES (*Ann. Bot., 19 (1905), No. 73, pp. 149–162*).—In continuation of the author's investigations on this subject, a report is given of experiments with papain from different sources and under different conditions.

In explanation of the action of papain two interpretations are offered, "(1) that a single protease is present, capable of both fibrin digestion and peptolysis, and that one or other of these activities may be more or less inhibited by the antiseptics, or (2) that two proteases are present in papain, which may respond differently and independently to the action of antiseptics." Of these two explanations the author prefers the second, which indicates that papain contains a fibrin-digesting protease of the nature of pepsin, and also a peptolytic protease of the nature of erepsin.

In continuation of other investigations (E. S. R., 14, p. 1051) the author has studied the proteolytic action of the foliage-leaves of various plants, and has added to the previous results, extending them to include the linden, rhubarb, and pokeweed (*Phytolacca decandra*).

The biology of Melanpyrum pratense, L. GAUTIER (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 21, pp. 1414–1416*).—A note is given on the biology of *Melanpyrum pratense*, a plant which is shown to be semiparasitic in its habit of growth, attacking through mycorrhiza the roots of a number of forest trees and many grasses. It seems to prefer the beech as a host plant.

The bast cells of the hypocotyl of flax, A. HERZOG (*Separate from Ztschr. Farb. u. Textil Indus., 3 (1904), Nos. 20, 21, 22, pp. 15, figs. 20*).—The results of a microscopical study of the bast cells of the flax plant are given.

How to know wild fruits, MAUDE G. PETERSON, illus. by MARY E. HERBERT (*New York and London: The Macmillan Co., 1905, pp. XLIII+340, pls. 18, figs. 60*).—This book is intended as a guide to the identification of plants in the northeastern United States by means of their fruits and leaves.

Evolution of cellular structures, O. F. COOK and W. T. SWINGLE (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 81, pp. 26, pl. 1, figs. 2*).—A discussion is given of a number of factors that are believed to have a bearing on the evolution of plants and animals.

FIELD CROPS.

The book of the Rothamsted experiments, A. D. HALL (*London: John Murray, 1905, pp. XL+294, pls. 8, dgms. 49*).—This is a general account of the Rothamsted experiments intended for the use of the student of agricultural science as well as the practical man.

It summarizes the mass of information which has already been published in the long series of Rothamsted Memoirs, adding "other facts and deductions arising out of the experiments which the original investigators had not hitherto been able to publish." The author attempts to make the subject "plain to the nontechnical reader and to elucidate the subject by diagrams and simplified tables, leaving the specialist to consult the original papers for fuller information."

The book contains a biographical introduction, including obituary accounts by R. Warington of Sir John Lawes and Sir Henry Gilbert; chapters on the sources of nitrogen of vegetation, meteorological observations, the composition of the Rothamsted

soil, experiments upon wheat, experiments upon barley, experiments upon oats, experiments upon root crops grown continuously on the same land, experiments upon the continuous growth of leguminous crops, experiments upon grass land mown for hay every year, experiments upon crops grown in rotation, nitrification, and the composition of drainage waters, feeding experiments, and miscellaneous inquiries; and appendixes giving lists of publications issued from the Rothamsted Experimental Station, 1843–1905, publications by other investigators dealing with material from Rothamsted, and other publications dealing with the Rothamsted experiments, and present officials and past and present workers at the Rothamsted Experimental Station.

"In this book little has been said of the work now in progress; speaking generally, the old plats as described are being continued without essential change, but the current investigations deal chiefly with the composition of the crops produced and with the soil. The bacterial life of the soil forms indeed the unknown territory which promises the greatest reward to the explorations of the agricultural chemist of to-day."

The Woburn field experiments, 1903, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 288–306*).—The results here reported represent the twenty-seventh season of the experiments.

The plan of the experiments has been described in former abstracts (E. S. R., 16, p. 352). In alternate years, including this season, some of the plats received in addition to mineral fertilizers, ammonia salts, or nitrate of soda, in quantities furnishing the same amount of nitrogen as 100 lbs. of ammonia. In the continuous wheat-growing experiments the crop this season was considerably below the average. The unmanured plat produced 9.5 bu. of grain and 10 cwt. of straw. Nitrate of soda alone increased the yield to 16 bu., and an equal quantity of nitrogen in the form of ammonia salts where lime had been previously used gave practically the same results. Nitrate of soda and ammonia salts given in moderate amounts with the minerals gave nearly equally good yields.

Heavy applications of nitrogenous salts showed injurious effects, but the highest yield of the season, 34.1 bu. per acre, was secured where mineral manures and nitrate of soda, in quantities furnishing the same amount of nitrogen as 100 lbs. of ammonia per acre, were used. The yearly application of rape cake, equal in nitrogen value to 100 lbs. of ammonia, gave a larger yield of grain and straw this season than the annual use of barnyard manure furnishing twice the amount of nitrogen.

Lime applied with ammonia salts, alone or together with minerals, produced a marked beneficial effect on barley. The unlimed plats, although treated with nitrogenous fertilizers, either with or without minerals, produced practically no crop. The best yield, 41.6 bu., was obtained with a heavy dressing of nitrate of soda given together with minerals. With the light dressing of nitrate of soda alone only 10.2 bu. per acre were obtained. The barnyard-manure and rape-dust plats gave yields below the average. The barnyard-manure plat produced the best quality of grain. As in previous years, green manuring with mustard and rape gave larger yields than green manuring with tares.

Three Canadian wheats, Preston, Red Fife, and Percy, were grown as spring and winter wheats. Red Fife gave much better yields, and the fall-sown grain was much superior in quality to the spring-sown grain. As compared with average English varieties they were superior in quality, but did not rank with them in yield.

Among varieties of clover from different sources English and Chili red clover ranked first. Seed from Oregon and Indiana also gave good yields. In experiments to improve old pasture it was found that potash increased the clovers and that barnyard manure increased the yields but at the expense of the clovers, favoring to a greater extent the more vigorous grasses.

Spraying potatoes gave the same favorable results as in former years, while the use of lime almost entirely prevented finger-and-toe disease in swedes.

The Woburn pot-culture experiments, 1903, J. A. VOELCKER (*Jour. Roy. Agr. Soc. England, 65 (1904), pp. 306–315, figs. 2*).

The Hills experiments.—In studying the influence of the iodids and oxids of manganese, potassium, sodium, and lithium on wheat the salts were mixed in the solid state with the upper 4 lbs. of soil in the pots.

The iodids were used at the rate of 1 cwt. per acre and the oxids at the rate of 2 cwt. The iodids of the 4 metals had an injurious effect, which was most marked in the case of the iodid of manganese (MnI_2). All the oxids had a beneficial influence on the growth of wheat, particularly the oxid of lithium. In the tests with barley all applications were made at the rate of 2 cwt. per acre. The iodids proved more injurious than in the experiments with wheat, while the oxids were neither harmful nor productive of a direct benefit.

The plants treated with lithium oxid were particularly healthful and vigorous, very broad-leaved, and well tillered. The results of water-culture experiments on barley with the iodids and oxids of manganese and lithium show that the iodids had an injurious effect on the root growth, being more marked as the strength of the solution increased. The oxids remained neutral. The manganese salts produced a thin, long, wiry root, and the lithium salts a thick, short, and stunted one.

Miscellaneous experiments.—From the results of a test with large and small kernels of barley for seed it is concluded that when the grains have good germinating power the smaller grains "are just as good or even better to sow than the large grains, and so long as the small grains are unbroken and sound there is no reason for considering their germinating power inferior to that of the larger grains."

[**Work with field crops**], J. S. COLE (*South Dakota Sta. Rpt. 1905, pp. 14–19*).—The report of the department of agronomy of the station for the year ended June 30, 1905. Brief notes are given on the experimental work in the rotation of crops and the adaptation and improvement of cereals, flax, and buckwheat. In connection with this work there were grown in 1904 230 varieties of wheat, 133 of barley, 95 of oats, 6 of rye, 5 of millet, 3 of buckwheat, and 3 of flax, and in addition nearly 600 selections were grown on plant-breeding plats.

Results of experiments conducted by the agricultural winter school at Frankenthal, V. RENNER (*Deut. Landw. Presse, 32 (1905), Nos. 51, pp. 435–437; 52, pp. 451, 452; 53, pp. 463, 464; 56, pp. 484, 485*).—Of 14 varieties of wheat Rimpau Bastard, Strube Squarehead, and Pfalz were best adapted to the region.

Pfalz is recommended for conditions of soil and rotation more or less unfavorable to the more productive varieties on account of winterkilling and summer droughts, while Strube Squarehead is considered suitable for farms on which winterkilling and summer droughts are not so likely to occur, and where soil and other conditions tend to produce heavy yields. Rimpau Bastard wheat was apparently suited to soils intermediate between those recommended for Pfalz and Strube Squarehead. This variety was found to require the use of high-bred seed from time to time for the purpose of maintaining its yielding power. The dry matter content of the grain was 87.83, 87.25, and 87.59 per cent, and that of protein 11.45, 9.99, and 11.15 per cent for Pfalz, Strube Squarehead, and Rimpau Bastard, respectively.

The results with rye indicated that Heine Improved Zeelander is best adapted to give good results with sufficient moisture, and that on very dry soils French Champaign gave the best results. Hannah rye seemed also well adapted to the dry soils, and has the advantage of ripening earlier and being less subject to lodging than French Champaign. On medium to light soils Petkus rye gave the best yields. Petkus is a high-bred variety, and under certain conditions subject to rather rapid deterioration, and for this reason the use of high-bred seed at certain intervals is recommended.

Third annual report of the Wisconsin Agricultural Experiment Association, R. A. MOORE (*Ann. Rpt. Wis. Agr. Expt. Assoc., 3 (1905), pp. 188, pls. 7, figs. 2*).—This report, compiled by R. A. Moore, secretary of the association, presents the

cooperative work during 1904 with soy beans, Swedish Select oats, alfalfa, and corn. Results with treating seed grain to prevent smut are also reported by a number of parties. The constitution and by-laws of the organization and the list of members for 1905 are given, and lessons in corn judging, with quite full discussions of the principal points, are outlined.

Agriculture in the North Central States, G. STIEGER (*Arb. Deut. Landw. Gesell., 1905, No. 104, pp. 70, figs. 25*).—Observations on farm management and farm life in the northern Mississippi Valley, mainly in Nebraska, Minnesota, and Wisconsin.

Agriculture without irrigation in the Sahara Desert, T. H. KEARNEY (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 86, pp. 30, pls. 5, fig. 1*).—The country known as the Oued Souf, situated in extreme southeastern Algeria, is described and its population, climate, water supply, soils, and date gardens are discussed.

The discussion on the date gardens includes descriptions of the methods of planting, care of the palms, and the harvesting of the crop. The manuring of the soil, the removal of the drifted sand from the gardens, the yields secured, and the varieties of dates chiefly grown are also considered. It is pointed out that in the Oued Souf, renowned for the large yields of its date orchards and the high quality of their fruit, the type of agriculture practiced is not dry land farming, as it depends upon the ground water, which in the gardens is everywhere near the surface of the soil.

It is further stated that the sand hills of the region concentrate and reflect so much heat that the hollows among them act as forcing houses in producing early dates. While the same conditions with respect to ground water may not be found anywhere in the United States, it is believed that the growing of dates in the hollows between the sand hills may be applicable to the hot arid regions of the Southwest, where large sand dunes exist, and where water for irrigation is available. "It seems certain that in pockets of this character excavated among the dunes the Deglet Noor and other valuable varieties of dates could be forced to early maturity."

The ripening of grain, A. NOWACKI (*Deut. Landw. Presse, 32 (1905), Nos. 57, pp. 491, 492; 59, pp. 505, 506*).—The author concludes from numerous experiments made at different times that the uneven ripening of grain is largely due to lodging and abnormally heavy stooling.

The breeding of varieties resistant to lodging by virtue of the normal structure of the stem is recommended. Attention is called to the fact that in a normal or ideal stem the internodes from the lower to the upper one increase in length and decrease in strength, according to a definite law which gives to each internode the average length and strength of the one immediately below and the one immediately above it. The normal stem obtains the greatest strength and flexibility with the smallest quantity of material in its structure.

Grain is said to lodge when the law of the arithmetical average with reference to the internodes is disturbed. This usually takes place in the second internode above ground, when the length and the thickness of the individual cell walls as well as of the entire internode are not in the right proportion to the length and thickness of the first and third internode. To illustrate, the author states that if the length of the first, second, and third internode from below is 1, 12, and 23 cm., respectively, the proportion is normal, while in a case where the corresponding lengths are 5, 18, and 19 cm. the second internode is 6 cm. too long.

This law, applied to the 3 lower internodes, is considered very important in breeding. In selecting plants with reference to their stooling qualities the author advises the choice of individuals with 3, 4, or 5 equally strong stems, uniform in development, and heading, blossoming, and ripening at the same time.

It is stated that when the kernel of wheat, oats, barley, and rye has a decided yellow color and a cross section reveals no trace of green chlorophyll, the grain is ripe for cutting. Notes on the condition of grain at this stage are given.

Grass lands of the south Alaska coast, C. V. PIPER (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 82, pp. 38, pls. 4*).—This bulletin has been partly noted from a condensed report on the same subject (E. S. R., 17, p. 349). In addition to the matter previously published the population, markets, transportation, climate, garden products, and fuel supply are discussed, and land laws applying to Alaska are given.

Contribution to the knowledge of Argentinian grasses, T. STUCKERT (*An. Mus. Nac. Buenos Aires, 3. ser., 4 (1905), pp. 43-161*).—Descriptions are given of 179 species and varieties of grasses.

The seeds of the blue grasses, E. BROWN and F. H. HILLMAN (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 84, pp. 38, figs. 35*).—This bulletin treats of the production and handling of blue grass seed, and gives descriptions and illustrations of these seeds and their impurities.

The germination, growing, handling, and adulteration of blue grass seeds, E. Brown (pp. 9–14).—Commercial and hand-gathered seeds are described and the grades and quality of commercial seeds discussed. It is stated that the more careful dealers in Kentucky blue grass seed maintain a purity standard of from 80 to 90 per cent in the so-called "fancy" grade, which is based on the relative cleanness and on the bright appearance of the seed, and that the grade known as "extra-clean" or "extra-cleaned" consists of the cleanings from the fancy seed, the samples as offered usually containing less than 10 per cent of seed of light weight. The rougher uncleaned seed as passed through a feed cutter contains from 60 to 70 per cent of pure seed.

That the unadulterated fancy grade is usually of good quality is demonstrated by the fact that the 2,887 samples tested by the Zurich Seed Control Station from 1876 to 1903 gave an average purity of 86.3 per cent. Sixty-nine samples tested in the Seed Laboratory of this Department during the past year showed an average purity of 75.02 per cent.

Samples of Kentucky blue grass seed sent to the Seed Laboratory have contained from 30 to 50 per cent of Canada blue grass seed, which is the only kind used as an adulterant of Kentucky blue grass in this country. A sample of wood meadow grass (*Poa nemoralis*), which is sometimes adulterated with other species of Poa, contained 59.4 per cent of *P. pratensis* and 23 per cent of *P. compressa*. It is pointed out that the standard weight of a bushel of blue grass seed of any grade is 14 lbs., but that the actual weight varies from 6 to 8 lbs. for the extra clean to 27 lbs. or more for especially good samples of fancy recleaned seed.

Reports from the Zurich Seed Control Station show that the average germination of 3,069 samples of Kentucky blue grass seed tested from 1876 to 1904 was 65 per cent, while 908 samples of *Poa trivialis* showed an average of 72 per cent. As carefully cured seed will germinate from 80 to 90 per cent, the low percentage of germination in the commercial seed is considered due to the heating of freshly stripped seed thrown together in piles. Notes on the growing and handling of 9 different species of blue grasses are given.

Descriptions of the seeds of the commercial blue grasses and their impurities, F. H. Hillman (pp. 15–38, figs. 35).—This part of the bulletin furnishes the necessary information for enabling seedsmen and others to distinguish the different species. A comparison of the principal distinguishing characters of blue grass seeds is given in a table. Keys to the seeds of the more common species of Poa as found on herbarium specimens, and of commercial blue grass seeds after preparation for market, are outlined.

Yellow oat grass, D. FINLAYSON (*Aynsome Agr. Sta., Seed-Testing Lab. Farmers' Bul. 7, pp. 3, figs. 5*).—A brief description of yellow oat grass is given, with notes on the purity, germination, and weight of the seed. Directions and illustrations are given for the determination of wavy hair grass, one of the common impurities.

Tall oat grass, D. FINLAYSON (*Aynsome Agr. Sta., Seed-Testing Lab. Farmers' Bul. 8, pp. 3, figs. 7*).—The habits and value of tall oat grass are described and the purity,

germination, and weight of the seed briefly noted. Soft brome grass, rye seeded brome grass, and darnel are given as the more common impurities of tall oat grass seed.

Meadow fescue, D. FINLAYSON (*Aynsome Agr. Sta., Seed-Testing Lab. Farmers' Bul. 9, pp. 8, figs. 6*).—This grass is described and its value, together with the purity, germination, and weight of the seed, is briefly noted. The most common impurities in the seed are dock, soft brome grass, rye seeded brome grass, perennial rye grass, and velvet grass.

Report on the manuring of seeds hay, 1904, W. ALLAN (*Edinb. and East of Scot. Col. Agr. Bul. 5, pp. 21*).—The results of 21 different tests showed that nitrogen was the fertilizing ingredient most required for the crop, and that nitrate of soda gave a better result than sulphate of ammonia, while a mixture of the two gave a slightly better result than either alone.

The plat receiving 40 lbs. of nitrogen per acre, which was the largest quantity applied, gave the heaviest yield of hay and the best financial return. Nitrogen alone gave satisfactory results. Phosphates had but little effect, and potash affected the yield more than phosphates. A complete application gave the best yield and the best returns.

Composition of forage crops, S. TRETYAKOV (*Khozvain, 1903, No. 52; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 1, pp. 102, 103*).—It is concluded that owing to a higher content of plant food, especially nitrogen, in the soil, with a dryer climate and a greater amount of sunshine the cultivated plants of southern Russia are generally richer in protein and ash than those grown in western Europe.—P. FIREMAN.

Trifolium incarnatum, D. FINLAYSON (*Aynsome Agr. Sta., Seed-Testing Lab. Farmers' Bul. 5, pp. 8, figs. 7*).—This is a popular bulletin giving a description of crimson clover with brief directions for its culture. The value of good seed is noted and some of the impurities commonly found in the seed are mentioned.

Adulteration of alfalfa and red clover seed, J. WILSON (*U. S. Dept. Agr., Office Sec. Circ. 14, pp. 2*).—A brief report on purity tests of clover and alfalfa seed bought in the open market.

Three samples of red clover seed contained from 10.55 to 26.85 per cent of yellow trefoil, this being the only adulterant, and in 19 samples of alfalfa seed the total adulteration ranged from 1.25 to 45.73 per cent. Of the samples of alfalfa seed one contained sweet clover, 7 bur clover, 3 yellow trefoil, and 8 bur clover and yellow trefoil together. The largest quantity of sweet clover found was 9.53 per cent; of bur clover, 16.86 per cent, and of yellow trefoil, 39.85 per cent.

Experiments with fodder beets in 1903–4, TOURNIÉROUX (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 35, pp. 269–281*).—The experiments here reported were conducted at the Colonial Agricultural School of Tunis.

The seed was planted in December, and by February 15 the plants were in good growth. The roots began to form about the first of April and were large enough for consumption by May 15, when the lower leaves began to dry, and by August 15 all the leaves were completely dead. Four varieties were grown, ranking in decreasing order of yield as follows: Géante de Vauriac, Ovoide des Barres, Disette Mammouth, and Demi-Sucrière.

The results with commercial fertilizers indicated that during a dry year the fertilizer application remains practically without results. Barnyard manure always gave the best returns. Beets in rows 40 cm. apart gave a marked increase in yield over those in rows 50 cm. apart. The results indicated that, in general, planting in November brings much better yields than planting about a month later.

A study of the composition of the beets showed that the maximum dry matter content was reached in June, and that the proportion and quantity of sugar was subject to nearly the same variations as the dry matter. The author concludes that the

conditions of culture in Tunis are so different from those in France that the performance records of a variety in the two countries can not be compared.

Corn growing in Virginia, A. M. Soule (*Va. Dept. Agr. and Immig., Farmers' Bul. 4, pp. 31, figs. 20*).—Corn growing in Virginia is discussed, the total yield of the State compared with that of several other States, and the possibilities of improving the industry pointed out. Directions are given for the selection of corn and the growing of seed. The causes of poor yields and the influence of planting upon the yield are considered. Notes are given on a number of record crops grown within the State, and the cost of producing corn on an 8-acre tract of land under Virginia conditions is estimated.

The production of good seed corn, C. P. Hartley (*U. S. Dept. Agr., Farmers' Bul. 229, pp. 23, figs. 10*).—This bulletin comments briefly on the general demand for well-bred seed corn and the need and importance of improved strains for different localities; describes more fully the important characters the stalk, ear, and kernel should possess, and outlines completely a method of corn breeding including the choice of a strain or variety, the selection of parent ears; the location, arrangement, and management of the breeding plat, and the selection of seed.

Directions for the care of seed corn and testing its germination are also given. Notes by H. J. Webber on the selection and care of seed corn when taken from the field instead of the breeding plat are appended.

Pedigreed seed corn, C. G. Williams (*Ohio Sta. Circ. 42, pp. 11, dgm. 1*).—A paper discussing the value of corn breeding, describing the arrangement of the breeding plat with directions for its management, and outlining a system by which pedigreed and certified seed corn may be produced.

Score card for dent corn (*Ohio Sta. Circ. 43, pp. 3*).—A score card for dent corn is given, with an explanation of the different points as they are applied in corn judging.

Cultivation of cotton on the Odessa Experiment Field, Rotmistrov (*Zeml. Ghaz., 1905, No. 9, pp. 364, 365*).—Experiments were made with American upland and Turkestan cotton. The American variety gave somewhat better results than the Turkestan.—P. FIREMAN.

Fertilizer experiments with hops near Saaz, A. Mahner (*Deut. Landw. Presse, 32 (1905), Nos. 52, pp. 452–454, figs. 5; 53, pp. 465, 466*).—The results of these experiments showed that the use of barnyard manure alone had no influence upon the development of the hop plant with reference to its structure, and that the commercial fertilizers were not injurious to the quality of the hops, as is contended by many producers.

A study of the lupulin content pointed out the importance of using a complete application of commercial fertilizers. Kainit when applied in the fall or winter was preferable to 40 per cent potash salt, while for spring applications the potash salt is recommended. Although barnyard manure was injurious to the proper development of the strobile and reduced the lupulin content, the author is of opinion that its use in hop culture is necessary for the maintenance of soil fertility, and that it is largely a question of when to apply it. The importance of barnyard manure in connection with hop culture is discussed, and a method of conducting fertilizer experiments in hop yards is described.

The peanut and its culture, W. N. Roper (*Petersburg, Va.: American Nut Journal, 1905, pp. 75, figs. 12*).—A brief treatise on the peanut industry of this country, giving directions for the culture of the crop and its preparation for market.

The injurious effect of crude potash salts on the potato, H. Süchting (*Landw. Vers. Stat., 61 (1905), No. 5–6, pp. 397–449*).—A series of pot experiments to determine the effects on the potato of magnesium, sodium and chlorin contained in crude potash salts is reported.

Sodium in the form of the carbonate had no injurious effect when 3.4 gm. of sodium oxid were supplied for every 19 gm. of soil. The plants containing the highest quantity of sodium at the period of most active growth gave the best yields, and the injurious effect of sodium chlorid independent of a general action of the salt is, therefore, considered due to the chlorin. When sodium salts were supplied the variety Daber took up more sodium, while in the other variety, Leo, no increase in this element took place. The application of sodium salts increased the quantity of potash used by the plants. During the most active growth the sodium is equally distributed throughout the plant, while at the close of the growing period it gathers in the parts above ground.

The difference between varieties in the degree of injury resulting from the impurities in the potash salts is ascribed to the difference in the nutritive effect upon the varieties of the potash furnished. The excess of chlorin in the leaves during growth, which resulted from the use of sodium chlorid, is partly transported to the tubers at the close of the vegetative period. The older variety, Daber, which sustained the greatest injury, retained more chlorin in its leaves than the newer variety, Leo.

The quantity of potash translocated in the leaves was also greater in the Leo than in the Daber variety. In either variety the application of sodium chlorid did not perceptibly impede the movement of potash from the leaves. Daber was better able to use the soil potash than Leo.

Influence of environment on the composition of the sugar beet, 1904, together with a summary of the five-year investigation, H. W. WILEY (*U. S. Dept. Agr., Bur. Chem. Bul. 96, pp. 66, pl. 1, charts 10*).—In 1904 the work was continued along the same lines as previously reported upon (E. S. R., 17, p. 457).

The seed used this season, grown at Fairfield, Wash., from Kleinwanzlebener mother beets exceptionally high in quality, germinated 169.5 sprouts per 100 seed balls. The best beets in so far as size is concerned were produced at Madison, Wis., and Geneva, N. Y., the topped beets weighing about a pound. Typical yields varying from 19.9 to 14.9 tons per acre were secured at Madison, Wis., Geneva, N. Y., and Agricultural College, Mich.

The beets produced in Michigan and Indiana contained about 15 per cent of sugar; those grown at Geneva, N. Y., and Blacksburg, Va., 13 per cent; at Ithaca, N. Y., and Madison, Wis., 12 per cent; and at Lexington, Ky., and Washington, D. C., 11 per cent. The beets from Madison, Geneva, Blacksburg, Lexington, and Agricultural College had a purity of over 81, while those from Washington, Lexington, and Ithaca ranged from 72 to 76 in this regard.

The stations having the highest temperature include Washington, D. C., Lexington, Ky., and Lafayette, Ind. The rainfall was greatest at Madison and smallest at Lexington, amounting to 22 and 13 in., respectively. The largest number of clear days occurred at Lexington and the smallest at Blacksburg. The percentage of sunshine was not obtained from all the stations, but the data reported gave Lexington the highest and Agricultural College the lowest.

The results obtained at 2 irrigated stations, Pomona, Cal., and Fort Collins, Colo., show a great superiority of the product at the Colorado Station, which is attributed largely to the low temperature at that point. The mean temperature for the growing season at Pomona was 8.6° higher than at Fort Collins. The precipitation at Fort Collins was almost as great as at Lexington. Pomona had nearly 3 times as many clear days as Fort Collins and 12.5 per cent more sunshine.

It is regarded as evident that the influence of latitude has 2 components, length of day and degree of temperature. Results obtained at Blacksburg indicated that the degree of temperature is by far the more important. In general the results show little relation between the hours of sunshine and the sugar content, and in this respect are entirely in harmony with those of previous years. The figures representing the content of sugar coincided, in general, with the purity of the juice and

the average length of day, and they show that there is a tendency to diminish the content of sugar by diminishing the hours of daylight.

The data further show that a high altitude may offset a low latitude in its relation to the sugar content, and they illustrated that the most depressing effects on the sugar content are produced by the combination of low altitude and low latitude. The conclusion is drawn that beets rich in sugar are most readily produced under favorable conditions combined with a high latitude and a high altitude.

A general summary of the data for the 5 years is given in the following table:

General averages of agricultural, analytical, and meteorological data from 1900–1904.

Station.	Number of years.	Estimated yield per acre.	Sugar in the beet.	Purity coefficient.	Meteorological data.			
					Temperature.	Precipitation.	Clear days.	Sunshine.
		Tons.	*P. cent.*		*°F.*	*Inches.*		*P. cent.*
Lexington, Ky	5	8.4	9.0	71.2	69.6	14.9	90	71.6
Washington, D. C	5	15.7	9.1	71.3	68.8	21.5	83	62.9
Blacksburg, Va	3	13.3	12.9	77.7	64.4	21.9	57	53.7
Madison, Wis	5	18.2	13.0	81.4	63.3	21.1	56	....
Lafayette, Ind	4	7.5	13.2	83.2	67.4	20.8	71	64.7
Ithaca, N. Y	5	13.3	13.2	79.0	62.1	18.8	48	60.4
Ames, Iowa	3	14.2	13.8	79.6	66.6	25.0	107	64.2
Agricultural College, Mich	4	13.4	14.2	83.6	62.3	19.8	63	59.6
Geneva, N. Y	5	16.1	14.6	85.1	64.0	20.0	....	....
Irrigation stations:								
Logan, Utah	3	18.9	13.2	81.2	62.1	5.9	126	78.7
Pomona, Cal	2	8.0	14.2	82.5	68.9	3.65	124	73.8
Fort Collins, Colo	3	20.4	14.7	83.9	59.4	11.0	80	63.8

The agricultural data show that in the 5 years the yields at Washington, Blacksburg, Madison, Ithaca, Ames, Agricultural College, and Geneva were in each case over 12 tons, while at Lexington and Lafayette approximately only a half crop was produced; and that at Raleigh, N. C., for 2 years the crop was practically a failure. The general proposition established by this series of investigations is that "temperature, or, in other words, latitude, is the most potent element of the environment in the production of a beet rich in sugar."

The results at the irrigated stations show that the predominating factor in so far as yield is concerned is the distribution of the water. It is also pointed out that the purity coefficient increases with the sugar content. The beets grown at Lexington were lowest in sugar and also lowest in purity, while those at Geneva with the highest sugar content were also highest in purity.

In studying the influence of rainfall it was observed that if its distribution or its deficiency produces a small crop of undersized beets, the percentage of sugar in the beet is incidentally increased, while a very abundant and well-distributed precipitation producing a beet of extraordinary size diminishes the percentage of sugar. The renewed growth of beets, due to a period of warm wet weather after they have reached a certain degree of maturity, also reduces the sugar content. It is concluded that the average data secured show no direct relation between the content of sugar in the beet and the number of clear days and percentage of sunshine.

In comparing the composition of the soil and the yield it is shown that the soil diminishes the sugar content when an overgrowth is produced by an excess of plant food, and causes an increase in sugar content to a slight extent when the amount of plant food is insufficient to produce a normal growth. The general conclusion from these and other experiments is that the soil and the fertilizers used have only a limited influence upon the actual sugar content, and that this influence was incidental rather to the vigor of growth than to any specific action on the sugar content itself.

The culture of sugar cane and the sugar industry in Hawaii and Réunion, L. Colson (*Paris: Augustin Challamel, 1905, 2. ed., pp. 431, figs. 26, maps 2*).—In discussing the culture of sugar cane, the soil, planting, use of fertilizers, irrigation, cultivation, yield, varieties of cane, rotation of crops, labor, cost of production, methods of transportation, experiment station work with sugar cane, and planters' associations are considered.

Descriptions of a number of plantations and sugarhouses are also given. Much of the information presented is compiled from bulletins and periodicals published in the Islands. The discussions on the manufacture of sugar treat of the methods and systems of machinery employed, the yields of sugar, uses and value of the by-products, and the cost of production.

Assimilation in the sugar-cane plant, Z. Kamerling (*Meded. Proefstat. Suikerriet West-Java, 1905, No. 81, pp. 9*).—The series of investigations here reported has been previously described and the results up to date have remained approximately as those previously reported (E. S. R., 15, p. 467).

Tobacco investigations in Ohio, G. T. McNess and G. B. Massey (*U. S. Dept. Agr., Bur. Soils Bul. 29, pp. 38*).—The climate of southwestern Ohio, the best tobacco soils of the region, comprising the Miami gravelly loam and the Miami clay loam, and the 4 principal varieties of tobacco grown in the Miami Valley, namely, Zimmer Spanish, Ohio seed leaf, Little Dutch, and Ohio Cuban, are described, and a report on growing Cuban seed tobacco and on the introduction of bulk fermentation in Ohio is presented. The work in the production and preparation of the crop in 1904 is described in detail.

The changes in temperature from November 21 to January 30 during the fermentation of a bulk containing 3,950 lbs. are tabulated. The changes in temperature of the bulk after "kasing," or adding water by artificial means, are also given. In the first bulk the temperature when allowed to run as high as the moisture in the leaf would admit did not go above 120° F. Early in February this bulk was taken down and rebuilt after each hand of tobacco had been dipped in water. Within 6 days the temperature had reached 121° F., when the tobacco was again taken down, shaken out, and rebulked. In this bulk the highest temperature, 120° F., was reached on February 25, after which the thermometer indicated a decline in the fermentation. After rebulking on March 1 the temperature did not rise above 109° F. and fell to 98° on March 31. When the tobacco was sized, graded, and rebulked to age the temperature averaged 102°.

A statement is given showing that the cost of growing Cuban seed tobacco in the experiment of 1904 was 10.5 cts. and the cost of fermenting and packing 4.5 cts. per pound. The tobacco lost in shrinkage about 13 per cent from the time it was cured to the time it was baled. Sixty-nine per cent of the crop was graded as heavy filler, 15 per cent as light filler, and 14 per cent as broken and trashy leaves. On the Miami clay loam 509 lbs. of leaf per acre and on the Miami gravelly loam 770 lbs. were secured. In experiments conducted in 1902, 2,191 lbs. of fermented tobacco was obtained from 6 acres of Cuban seed leaf. Five acres of Zimmer Spanish this same year yielded 748 lbs. per acre. In 1903, 7½ acres of Cuban seed tobacco on Miami clay loam yielded 3,950 lbs. of air-cured leaf, which weighed 3,451 lbs. when fermented and baled.

In December, 1904, the Zimmer Spanish was sold at 16½ cts. per pound, but the Ohio Cuban was not sold because the leaf was a little too heavy. Neither of these types of tobacco was up to the standard of quality, due to unfavorable climatic conditions. The Ohio Cuban grown in 1903 was sold at 35 cts. per pound, less 3 per cent for cash, giving a return for the finished product of $143.85 per acre.

Complete directions are given for fermenting in bulk, together with the details of fermenting different types of leaf. Changes in temperature of bulks of Zimmer Spanish, Ohio seed leaf, and Little Dutch are recorded. The Bureau introduced the bulk

method of fermentation in 1902, when 655,200 lbs. of Zimmer Spanish was treated by this method; in 1903, 4,212,000 lbs., and in 1904, 10,208,000 lbs., consisting of Zimmer Spanish, Ohio seed leaf, and Little Dutch, were fermented in bulk under its direction.

Experiments in growing Sumatra tobacco under shelter tent, 1903, W. FREAR (*Pennsylvania Sta. Bul. 72, pp. 11*).—Cooperative experiments in growing Sumatra tobacco under shade were conducted on two farms, one on Donegal gravelly loam soil and the other on Penn sandy loam. Similar experiments were made on the Donegal gravelly loam in 1902.

Notes on the weather conditions and the culture, harvesting, and curing of the crop are given, together with statements relating to the expense involved in the different operations. The crops were bulk-sweated with other Sumatra leaf, and graded according to the Connecticut standard. In the crop from the Donegal gravelly loam soil the loss from sweating and in rejected leaf amounted to 21.9 per cent. In the sweated crop 34.2 per cent of the leaves were graded as light-colored and 47.9 per cent as dark. Of the selected leaf 58.4 per cent was regarded as fit for wrappers. About three-fifths of the crop consisted of leaves over 16 in. in length.

The results so far obtained indicate that the shade-grown leaf on the Donegal gravelly loam, lacking in luster, life, and color, is not a satisfactory substitute for imported wrapper leaf, but that on the lighter Penn sandy loam a leaf of more acceptable color, better luster, and less flimsiness is obtainable.

Tobacco investigations in Porto Rico during 1903–4, J. VAN LEENHOFF, Jr. (*Porto Rico Sta. Bul. 5, pp. 47, pls. 5, fig. 1*).—This is the Spanish edition of Bulletin 5 of the Porto Rico Station, the English edition of which has been noted (E. S. R., 17, p. 32).

Improving the quality of wheat, T. L. LYON (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 78, pp. 120*).—This bulletin contains a historical and an experimental part.

The historical part consists of a brief summary of a number of experiments made from 1845 to the present time in this and other countries, and bearing on the influence of the time of harvesting, the use of immature seed, the conditions of soil and climate, the supply of soil moisture, and the size or weight and the specific gravity of the seed on the composition and yield of wheat.

The experimental part presents the results obtained by the author in breeding experiments conducted at the Nebraska Experiment Station in cooperation with this Department. The object of the investigations was to determine whether a high or low nitrogen content may be a characteristic of an individual plant, whether this quality is transmitted to the offspring, with what constant characteristics it is correlated, and whether a high percentage of nitrogen in a normal matured wheat plant indicates a large accumulation of nitrogen by that plant.

The data indicate that when grown under the same conditions kernels of the same variety high in proteid material have a lower specific gravity, weigh slightly less, and occupy a smaller volume than kernels having a smaller percentage of proteids. The same relations obtain between individual spikes and individual plants, but the relation of light kernel and high percentage of nitrogen did not appear to hold between individual plants in different years. As between kernels, spikes, and plants the kernels of greater weight contained a larger weight of proteids, although a lower percentage.

The quality of high proteid content and its correlated properties, it was found, may be due to immaturity in the kernel, or they may belong to the normal and fully ripened kernel. It was further shown that plants bearing either the largest number or the greatest weight of kernels as well as those producing the greatest weight of proteid matter and gluten have kernels of more than medium, but not the greatest weight.

Seed wheat separated into heavy and light seed and sown at the rate of 1½ bu. per acre produced much the larger crop from the heavy kernels, but only a small difference in yield resulted from selecting heavy seed from the crop grown from heavy seed, and light seed from the crop grown from light seed, during the 3 or 4 succeeding years. After the first year the light seed produced a greater amount of protein per acre than did the heavy seed. The 2 rows of spikelets in the head presented a fairly close agreement as regards the total or the proteid nitrogen content of the kernels, and the same was found to be true for one-half the number of spikes, as compared with the other half on plants with at least an average number of spikes.

The data also show that there may be quite a large variation in the proteid nitrogen content of different spikes on the same plant. That of 800 spikes of different plants of the same variety varied from 1.12 to 4.95 per cent, and 351 plants of the same variety the following year varied from 1.20 to 5.85 per cent. As the proportion of gluten to proteids in kernels of different wheat plants was found to vary considerably in certain cases, it is recommended that selection for improvement should be based on the determination of gluten. Plants with kernels high in gluten contain a smaller proportion of other proteids than plants medium or low in this constituent.

In wheat of the same variety grown under identical conditions, the relation of gliadin to glutenin was practically the same in plants varying largely in proteid nitrogen, and it is therefore assumed that an increase in the gluten content of a given variety raised in the same region would improve, on the average, its value for bread making.

The content of proteid nitrogen, the kernel weight, and the total proteid nitrogen production by the plant are considered hereditary qualities, and it is pointed out that plants possessing any of these qualities in an extreme degree show a tendency to produce progeny in which the same qualities approach more closely to the average, but that certain exceptional plants may transmit the same or more extreme qualities.

The yield of grain per plant was decreased in proportion to its susceptibility to cold, the effect of a severe winter being to reduce its tillering capacity. Early maturing plants, as compared with later maturing individuals, gave better yields, but the grain was slightly lower in nitrogen content and the number of grams of proteid nitrogen in the average kernel was also less. Plants with heads of slightly more than medium size produced the largest yields of grain and were taller than plants with either larger or smaller heads, while plants with heads of medium size, or slightly less, tillered most extensively. The weight of the average kernel did not increase or decrease with the size of the head, although on the very largest heads it was reduced. The largest yielding plants were the tallest and tillered most.

The variability of wheat varieties in resistance to toxic salts, L. L. HARTER (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 79, pp. 48*).—Experiments were conducted to study the effect of the harmful salts present in the so-called alkali soils of the West on the growth of wheat.

Varieties representing very different conditions of climate and soil were selected and a description of each is given. The seeds were germinated in sphagnum moss, and only seedlings having healthy and vigorous rootlets were used. When the radicles were from 3 to 4 cm. long the seedlings were taken out of the sphagnum and the tips of the roots immersed in the different salt solutions. After 24 hours they were taken up, the elongation of the rootlets measured and transferred to hydrant water, where they remained for another 24 hours. The radicles showing additional growth in the hydrant water over the growth in the salt solution were considered as having survived, and those making no additional growth as being dead.

Usually the experiments lasted about 10 days, and from 60 to 100 seedlings were used to establish the toxic limit in each case. The results are brought together in the following table:

Resistance of wheat varieties to various salts in terms of fractional parts of a normal culture.

Name of wheat variety.	Magnesium sulphate.	Magnesium chlorid.	Sodium carbonate.	Sodium bicarbonate.	Sodium sulphate.	Sodium chlorid.
Zimmerman	0.0075	0.015	0.0125	0.028	0.05	0.065
Kharkof	.00625	.01	.015	.03	.0425	.055
Padui	.0075	.01	.01	.0275	.045	.0575
Kubanka	.0075	.00875	.0075	.025	.05	.0575
Turkey	.01	.0075	.015	.0275	.0425	.05
Maraouani	.0075	.01	.008	.0225	.0475	.055
Budapest	.01	.0125	.005	.025	.0375	.0475
Preston	.005	.005	.0125	.025	.035	.055
Chul	.005	.005	.0125	.025	.04	.045
Average	.00736	.0093	.0109	.026	.0433	.0542

The ash constituents of the wheat seedlings were also determined, but no correlation between the amount or the composition of the ash and the resistance of the seedlings to saline solutions was established. The author compares some of his results with those obtained by other investigators in work with lupine and maize, as follows:

Differences in the toxicity of the same salts to wheat, lupine, and maize.

Salt.	Degree of concentration.					
	Wheat.		Lupine.		Maize.	
	Parts of a normal solution.	Parts per 100,000 of solution.	Parts of a normal solution.	Parts per 100,000 of solution.	Parts of a normal solution.	Parts per 100,000 of solution.
Magnesium sulphate	0.007	39	0.00125	7	0.25	1,400
Magnesium chlorid	.009	108	.0025	12	.08	384
Sodium carbonate	.01	52	.005	26	.015	78
Sodium bicarbonate	.026	217	.02	167	.05	417
Sodium sulphate	.043	302	.0075	53	.05	353
Sodium chlorid	.054	313	.02	116	.04	232

It may be observed from this table that while magnesium sulphate is the most toxic to the wheat and the lupine of all the salts used, it is the least injurious to maize.

It is shown that the ratio of resistance of one variety of wheat to another varies for different salts, being in general greater for the more toxic salts and smaller for those less toxic in their effects. The greatest ratio of resistance between varieties, 1:3, was observed in the tests with sodium carbonate and magnesium chlorid. In the magnesium sulphate tests this ratio between the most and the least resistant varieties was 1:2. The average resistance of a variety was not correlated with its resistance to the different individual salts.

It is pointed out that a variety averaging least in resistance may be much more resistant to a particular salt than the variety averaging highest, and that this fact may be of value in selecting varieties for soils containing an excess of some one salt. Varieties from localities where toxic salts are abundant in the soil are most resistant in water cultures to these salts, while those from humid regions are less resistant. Individual variation makes the establishment of the toxic limit in some varieties more difficult than in others. In all cases the resistance of a variety must be worked out for itself.

All the salts used, except sodium carbonate and sodium chlorid, acted as stimulants, the elongation in some cases being twice that occurring in hydrant water. It was

found that absolutely pure distilled water does not hinder development, but that traces of zinc are sufficient to kill the root tips in 24 hours. It is believed that water culture experiments may be a means of saving several years of selection by indicating whether a variety is adapted to soil conditions in a particular region.

Cultivation of wheat at the Bathurst Farm, R. W. PEACOCK (*Agr. Gaz. N. S. Wales, 16 (1905), No. 5, pp. 455–459, fig. 1*).—The cultivation of wheat at the farm is described and the results with a list of varieties reported. Among 11 varieties Tarragon and Cleveland led in productiveness, with yields of 38 bu. 43 lbs. and 36 bu. 21 lbs. per acre, respectively.

Cultivation of wheat at Glen Innes Experimental Farm, R. H. GENNYS (*Agr. Gaz. N. S. Wales, 16 (1905), No. 5, pp. 459–462*).—Wheat was grown at this station at an elevation of over 3,000 ft. and with a rainfall of 14.5 in. during growth. The varieties leading in yield were Sussex, with 34.26 bu., and Tardent Blue, with 30.5 bu. per acre.

The position of the wheat grains in the head in relation to seed selection, J. ADORJÁN (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 6, pp. 609–628*).—The results of the investigation here reported show that the heaviest kernels stood lowest in mealiness and highest in protein content. In connection with these qualities these grains also ranged first in specific gravity, and the author points out the value of this fact in selecting them for seed by means of centrifugal force.

From the data obtained the author concludes that the third or fourth kernel in the spike, counting from below, is the heaviest and probably also highest in specific gravity, and recommends therefore that these kernels be selected for seed.

The quality of the seed in its relation to the yield of wheat, J. ADORJÁN (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 6, pp. 629–632*).—The results of an experiment with selected seed, conducted in duplicate, show that the seed representing the fourth kernel from the lower end of the spike produced the largest yield, and that the productivity of the seed decreased as the kernels were taken higher or lower in the head.

Variety tests with winter rape, T. REMY (*Deut. Landw. Presse, 32 (1905), No. 54, p. 472*).—Seven varieties were drilled August 15, at the rate of about 11 kg. per hectare in rows 30 cm. apart.

Canadian, one of the earliest varieties, ranked first in yield, with 26,600 kg. of seed per hectare. Dutch rape, which yielded the largest quantity of straw, was one of the lowest in seed production. Canadian also led in fat content of the grain, with 43.91 per cent. The results likewise indicated that the rank-growing Holstein rape is best adapted to a good soil and a mild winter climate, while Dwarf rape can be grown on poor soils and under more unfavorable weather conditions.

A common error in germination tests (*Abs. in Centbl. Agr. Chem., 34 (1905), No. 4, pp. 253–255*).—The germination in a seed tester of 31 samples of seed of oats and wheat ranged from 49 to 99 per cent, but the results obtained with this seed under field conditions differed widely from these figures.

Of oats having shown a germination of 94 per cent only 54 per cent was viable in the field, and of another lot with a germination of 81 per cent in the tester only 13 per cent produced plants when sown in the open soil. Two lots of wheat having shown a germination of 63 and 62 per cent contained only 8 and 4 per cent, respectively, of viable seeds under field conditions. The average difference in germination in the tester and viability in the field was 34 per cent.

This seed was produced under abnormally low temperature conditions and had been injuriously affected by early fall frosts. Upon further investigation it was found that the embryos either lacked normal development or had sustained injuries. The embryos in many cases were bent and in some instances approached a spiral shape. An injured condition was also manifested by a brownish-colored tip or base.

The vitality of buried seeds, J. W. T. DUVEL (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 83, pp. 22, pls. 3, fig. 1*).—From December 19 to 23, 1902, 32 sets of 112 samples of seeds, each representing 109 species, 84 genera, and 34 families, were mixed with earth, placed in porous clay pots, and buried in heavy clay soil. Eight sets were buried 6 to 8 in. deep, 12 from 18 to 20 in., and 12 more from 36 to 42 in. deep. Of the larger kinds each sample contained 100 seeds, but for most samples 200 seeds were taken. Control samples were stored in cloth bags in a dry room.

A complete series of 3 sets was taken up in November, 1903, and subjected to germination tests in the greenhouse, together with complete sets of control samples tested in the greenhouse and in the germinating chamber. The tabulated results of the tests show that 24 species of the buried seeds had either decayed or germinated and afterwards decayed, and that the seeds of 73 species had not completely lost their vitality while buried. Results as to the remaining species were indefinite.

Corn, sweet corn, corn cockle, cabbage, cotton, peas, beans, buckwheat, wheat, and barley were all decayed when taken up. The seeds of cheat (*Bromus secalinus*) and upright cheat (*B. racemosus*) completely lost their vitality, and it is concluded that where cheat is found in grain fields or elsewhere it has come from seed recently sown.

In studying the relation of depth of burial to vitality the average germination of all samples was found to be as follows: Original tests, 63.2 per cent; control samples in germinating chamber, 57.5; control samples in greenhouse, 53.2; samples buried 6 to 8 in., 20.5; buried 18 to 22 in., 26.5; and buried 36 to 42 in., 31 per cent. The seeds of the Trifoliums and closely related genera, including Lespedeza and Medicago, deteriorated very greatly while in the soil.

The seeds of the common cultivated sunflower, common garden lettuce, and oats had lost their vitality, while those of the wild sunflower germinated 43.5, 64, and 66.5 per cent; those of prickly lettuce 63.5, 69, and 69.5; and of wild oats (*Avena fatua*), 9, 8, and 18 per cent, respectively, for the 3 different depths.

From these results it is pointed out that many weeds can be destroyed by deep plowing and leaving the soil undisturbed for some time; that the seeds of cultivated plants lose their vitality, while the seeds of weeds retain their power to grow remarkably well when buried; and that the vitality in all seeds is best preserved by careful harvesting and storing in a dry and comparatively cool place. The results further indicated that the deeper seeds are buried the better the vitality is preserved; that hard seeds of the same species retain their vitality much better than those with softer seed coats; and that unhulled seed, especially of the grasses, retains its power of growth better than hulled seed.

Destruction of wild mustard, J. B. MARTIN (*Prog. Agr. et Vit. [Ed. l'Est], 26 (1905), No. 21, pp. 634–636*).—Of different solutions used for the destruction of wild mustard, a 3 per cent solution of copper sulphate and a 20 per cent solution of iron sulphate were most effective, but the iron sulphate was injurious to the crop.

HORTICULTURE.

Tomatoes under glass. Methods of pruning tomatoes, G. E. STONE (*Massachusetts Sta. Bul. 105, pp. 3–28, 38, 39, figs. 5*).—A summary is given of the results secured at the different experiment stations in this country with tomatoes as regards soils and fertilizers, solid beds and benches *v.* pots, transplanting, pollination, time required to grow crop, yield per square foot, pruning, etc., with the details of experiments by the author on pruning tomatoes.

In one experiment, when a few of the lower leaves were removed from plants trained to a single stem, there was a gain of 32 per cent in stem growth and 18 per cent increase in the size of the fruits over unpruned plants. In 3 other experiments extending over 1, 2, and 3 months, respectively, with plants trained to 2 stems, the

removal of the lower half dozen or more leaves resulted in an increased gain in size of the fruit of 21, 10, and 6 per cent, respectively. These results indicate that the beneficial influence of pruning off the lower leaves gradually decreases with time. The results of experiments in training to different numbers of stems is summarized in the table below:

Yield and size of tomatoes by different systems of pruning.

System of pruning.	Number of plants.	Average weight of fruit.	Average weight of fruit per plant.	Average number of fruit per plant.
		Grams.	*Grams.*	
One stem	17	112	4,135	38
Two stems	50	96	4,874	50
Three stems	25	90	5,212	57
Four stems	8	85	5,027	58
Normal	19	84	4,383	53
Three stems, leaders cut	8	150	5,444	36

When the leaders were not cut back the smallest number of fruit per plant was obtained on the plants trained to a single stem. These fruits were of good size and the plants thus trained produced the earliest fruit of all the different methods of training. The yield also on equal amounts of trellis space was the greatest by this system of training.

"The greatest average weight of individual fruit, as well as the greatest weight per plant, however, was given by the 3-stem system where the leader was headed in, whereas in the average number of fruit per plant this system is lowest. There was only one experiment in which heading in was practiced. . . . In general, however, these experiments show that if we wish to obtain large fruit with a tolerably good number per plant the single leader constitutes one of the best systems, with the 2, 3, and 4-shoot systems following in tolerably uniform succession. No doubt the largest fruit and the greatest acceleration in maturity can be obtained by heading in the leader. . . .

"Undoubtedly the best system of growing greenhouse tomatoes is to plant 12 to 16 in. apart in the rows, prune to the 1-stem system, and head in or cut back the leaders above the fourth or sixth cluster of fruit, as circumstances require."

The principles of mushroom growing and mushroom spawn making, B. M. Duggar (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 85, pp. 60, pls. 7*).—The results are here given of a number of years' research work on the problems of mushroom culture and spawn production. The more popular results of the work, including efficient methods of spawn production, are reported in one of the farmers' bulletins of this Department (E. S. R., 16, p. 367).

In the present bulletin the more technical phases of the work are given, including the results of spore germination, studies of different nutrient solutions, tissue cultures of different species of mushrooms and media for their growth, temperature and moisture experiments, compost preparation, installing, spawning, and casing beds, comparisons of different kinds of spawn, experiments in mushroom culture, and tests of the vitality of mushroom spawn. Detailed directions are given for mushroom spawn making on a commercial scale. An account is also given of the cave facilities in the United States and a discussion of the open-air culture of mushrooms The principal species worked with was *Agaricus campestris.*

Further work by the author has confirmed the results of Miss Ferguson (E. S. R., 14, p. 121) relative to the value of small portions of mycelium of the mushroom fungus in stimulating spore germination. The tissue-culture method of spawn production has been satisfactory for at least 40 species of mushrooms grown. The addition of nutrient salts to sterilized media in tissue cultures was not found useful. Acid media does not give satisfactory results.

The best temperature at which to grow mushrooms is placed at 53 to 58° F. They grow more rapidly at a higher temperature, but such higher temperature also favors the development of foreign fungi, molds, and bacteria, as well as insects, and the quality of the mushroom does not appear to be as good as with the lower temperature. Freshly fermented manure gives the best results in mushroom culture and should include the straw used in bedding the animals. Cereal straw appears to be better than that from grasses. The manure from horses fed hay and green feed does not give satisfactory results.

Commercial fertilizers appear to add nothing to the value of good horse manure for mushrooms, though beds to which cotton-seed meal were added gave slightly increased yields. The experiments indicate that the temperature of the beds should be allowed to fall to about 70° F. before they are spawned. Exhausted beds should be discarded from the standpoint both of profit and sanitation.

Outdoor mushroom culture is seldom commercially profitable, since temperature and moisture conditions can not be controlled. It is thought that the most favorable regions for mushroom culture out-of-doors are in Eureka and San Francisco, Cal. The absolute moisture condition for mushroom beds and bricks in spawn making is placed at 40 per cent. The vitality of spawn appears to decrease rapidly with age. Brick spawn appears to maintain its vitality longer than the flake material.

A number of American firms are now manufacturing spawn in accordance with the methods described by the author. About 50,000 bricks were sold in 1904, and it is believed that this amount will be increased to several hundred thousand in 1905.

Pure culture mushroom spawn, F. CANNING (*Amer. Florist, 24 (1905), No. 891, p. 1029*).—The author states that he has used a number of pounds of the pure mushroom spawn developed by this Department.

A noticeable feature of the mushrooms produced from this spawn appears to be the evenness of size, weight, solidity, and tenderness. At the time of writing mushrooms averaging ¼ lb. in weight were being picked which had not lost their tenderness. The Columbia variety is considered especially satisfactory, as it looks well for market.

Edible and poisonous mushrooms, G. MCCARTHY (*Bul. N. C. Bd. Agr., 26 (1905), No. 1, Sup., pp. 3–24, figs. 4*).—A botanical classification and illustrations and descriptions are given of a large number of edible and poisonous mushrooms which grow in North Carolina.

The American fruit industry and the development of American fruit exports, P. J. SCHLÖSSER (*Die amerikanische Obstindustrie und die Entwickelung des amerikanischen Obstexportes. Frankfort: Trowitzsch & Son, 1905, pp. 72, dgm. 1*).—The author visited America and describes the fruit industry in different sections of the country with reference to cultural practices and the utilization of the different fruits. Statistics are given showing the exports of fresh, canned, and evaporated fruits from the United States to different countries of the world.

General considerations in regard to pruning, G. E. STONE (*Massachusetts Sta. Bul. 105, pp. 33–39, figs. 3*).—A discussion of some of the general principles of pruning plants.

Winter injury to fruit trees, H. J. EUSTACE (*New York State Sta. Bul. 269, pp. 323–343, pl. 1*).—An account is given of the injuries to fruit trees in different sections of New York during the winter of 1903–4, which was unusually long and cold, and of different methods of treating injured trees.

The minimum temperature of the winter ranged from −10° to −15° F. in the fruit-growing sections of western New York and −40° F. in the Hudson River Valley. The season of 1903 had been especially trying on the trees, owing to early and prolonged drought, excessive fall rains, and serious ravages by insect pests. These factors combined with the long cold winter caused the unusual injury. All kinds of fruits were more or less injured, the peach and pear suffering most. The branches and trunks were most commonly injured, the roots seldom.

The external appearance of injured trees at the end of the winter was normal, but upon cutting into the trunk anywhere above snow line the bark and wood showed marked discoloration which decreased in intensity from the snow line up. It was found impossible to tell by the appearance of the wood and bark in the spring whether a tree was dead or not, since some trees in which both wood and bark were discolored black and which all believed were dead recovered from the injury and made a good growth during the succeeding two years. The intensity of the discoloration, however, is an index of the degree of injury.

Peach trees, 1 to 6 years old, were much less injured and recovered much more rapidly than older trees. Badly discolored pear trees, 2 to 5 years old, usually recovered. Generally speaking, older trees were much more seriously injured than young trees. Orchards located on low sites and in hollows or pockets were injured most and the wind damaged many orchards on exposed western slopes. A list is given of varieties of apples, peaches, pears, cherries, blackberries, quinces, and grapes that were most injured.

In experiments to determine the best method of pruning injured trees some young trees were cut back below the snow line. Older trees were sometimes cut back to the large limbs or "dehorned," sometimes moderately pruned, or left unpruned. Peach or pear trees, 7 or 8 years old or more, when pruned back to the main branches, were killed, while the young trees thus treated generally recovered and made a satisfactory growth. Both old and young trees moderately pruned back usually made a good recovery and were often thus saved when trees not pruned back at all died. Many of the trees not treated at all, however, recovered from the winter injury and made a fair crop of fruit in 1905. Trees that did not bear a crop of fruit in 1904 made a much better recovery than those that carried even a light crop. Moderate pruning on the whole gave much more favorable results than no pruning.

The apples of New York, I, S. A. BEACH, N. O. BOOTH, and O. M. TAYLOR (*New York State Sta. Rpt. 1903, pt. 2, pp. XX+409, pls. 129, figs. 10*).—A comprehensive account of the apples grown in New York, including notes on the botanical classification of apples, the origin and development of apple culture in New York, the adaptation of varieties to particular regions, and a discussion of what a variety is, with technical descriptions of all of the varieties of winter apples grown in New York and an account of their commercial importance.

The apples described include varieties which are in season with Tompkins King and Hubbardston and all those which ripen later. Under each variety described references to the literature on the variety are first given, its synonyms are then noted, followed by an historical account, and then a description of the tree, fruit, season of ripening, uses, etc.

On account of its completeness this report should prove of unusual value to orchardists. It is attractively and substantially bound and the numerous half-tone and colored plates serve a distinctly useful purpose in the determination of varieties.

Fifth report of the Woburn Experimental Fruit Farm, DUKE OF BEDFORD and S. U. PICKERING (*Woburn Expt. Fruit Farm Rpt., 5 (1905), pp. 121, pls. 2*).—This report deals with the results of experiments with apple trees. The work was begun in 1894 and has been carried on continuously since.

The general plan of the experiments and results secured up to 1900 have been previously noted (E. S. R., 12, p. 749). The injurious effects of grass on apple trees and the probable cause of the same has since been reported upon (E. S. R., 15, p. 474), as has also the results of fertilizer experiments (E. S. R., 16, p. 875). Most of the work has been carried on with dwarf trees, though standards have been used in many instances.

The size of the leaf and fruit of apple trees has been found to decrease quite uniformly with the age of the tree up to ten years. The size of the fruit does not appear to be influenced by the size of the crop so long as the crop is not so excessive

as to overload and weaken the tree. Thinning the crop below this limit is, therefore, of no advantage. Cutting back the trees at the time of planting out has resulted in more fruit than where the trees were not cut back until a year later Unpruned trees have borne crops three times the value of those pruned severely and 50 per cent greater than those pruned moderately. It is thought that with precocious trees these results might not hold.

Summer pruning, shaping, and pinching have not produced useful results. No difference in results has been observable whether trees were pruned in the early fall, midwinter, or spring, or whether they were pruned during or just before hard frosts.

Root pruning trees every year practically stopped all growth. Less frequent root pruning resulted in proportionately less injury. Recovery began the second year after root pruning was done and was accompanied by relatively heavy fruiting. Two-year-old bush apple trees proved better for transplanting than 1, 3, or 4 year old trees. Two-year-old standard trees also proved better than 4-year-old trees.

The effect of grass 5.5 and 6 ft. away from apple trees produced marked results. The crops on these plats were more than double the normal without any diminution in the size of the fruit. The fruit which normally was of a deep green, occasionally tinged with red, assumed a brilliant red color, and in storage kept much better. The variety Potts kept 3 months longer than usual, and Bramleys were still good in June at the time of writing.

The serious injury of grass on the growth of apple trees, when it occupies the whole area under the trees, was brought out in former reports (E. S. R., 12, p. 749; 15, p. 474). The present experiment is believed to illustrate how a kind of treatment that is very injurious when carried to excess may be very beneficial when adopted in moderation. The amount of tree roots which entered the grass area was determined in 3 instances and amounted to but 0.9 to 2.4 ounces per tree. "Yet they must have conveyed something to the trees which has been sufficient to modify the whole character of the crop. This points strongly to the view that the action of the grass is due to some active poison."

Notwithstanding increased crops, higher colored fruit, and improved keeping quality, growers are cautioned against attempting to improve their fruits by partially grassing over their orchards, since the line between beneficial and injurious effects of grass is very narrow and requires further study. No difference has been noticed in the action of different grasses on the fruit. Grassing over pears, cherries, and plums has led to the same injurious effects as with apples. The application of iron sulphate or manganese sulphate at the rate of 27 lbs. per acre has had no noticeable influence on the color of apples.

Careless planting of trees, such as hacking off the roots with the spade, huddling them into too small holes when planting, pointing the roots downward, filling in the holes and packing down the dirt without any attempt at working it in around the roots, resulted in impairing the vigor of the trees during the first year or two, after which the trees recovered and at the end of 3 or 4 years had made a much better growth on an average than trees planted carefully according to accepted methods.

The reason for this better growth is thought to be explained by some other experiments in which trees were planted 2 ft. deep or more. The roots of the trees thus treated made no growth, but a new system was established from dormant buds at the usual depth, after which these trees made unusually good gains, overtaking trees planted normally. The point is made that this entirely new root system which had never been disturbed by transplanting served the trees better than the old system, and it is held that careless transplanting, combining the methods noted above, would likely lead to the establishment of a new root system.

Shortening the roots one-third of their length at the time of transplanting impaired the vigor of the growth of the trees but little, but removing two-thirds seriously

dwarfed the trees. Trees set 3 ft. deep in the ground and the soil put back in either reversed or regular order resulted in the dying of the old root system and the development of an entirely new root system at the usual depth of 6 to 12 in.

The older the trees were at the time of transplanting, the longer was the time required to develop the new root system. Trenching or subsoiling the hard clay subsoil of the experimental plats was without benefit to apples. Planting trees 4 in. too high or too low has not made any difference in the results obtained, the trees having readily adjusted themselves to their normal level. Trees appear to sink into the ground as they grow.

Mixing peat or compost in amounts equal to the bulk of soil removed in a square yard in planting has resulted in an increased growth due, it is thought, to the poor physical condition thus brought about. No such benefit has been obtained when chalk, flints, or gravel have been so used. Very early fall planting of trees was found advantageous, but there was no choice between plantings made in November and the following April.

The removal of apple blossoms was found very beneficial in the growth and future productiveness of early-bearing trees. Trees thus treated appeared to bear heavier crops for several years afterwards and not only the year when they were first allowed to bear. With varieties that come into bearing later it was not of so much advantage. During the early life of apples the trees may bear well or badly for several years in succession, but as they grow older there is a strong tendency toward bearing only in alternate years.

Extensive tables are given showing the measurements, etc., of the trees reported upon in the different experiments mentioned above. In the text the experiments themselves are explained and discussed at length.

The ripening of peaches, W. D. Bigelow and H. C. Gore (*Jour. Amer. Chem. Soc., 27 (1905), No. 8, pp. 915–922*).—A study was made of the composition of peaches at various stages of growth. The work of analysis began immediately after the June drop. The fruit was examined again when the stone began to harden and could be cut through with a knife only with difficulty, when market ripe, and when fully ripe. The varieties Triumph, Rivers, Early Crawford, Stump, Elberta, Orange Smock, and Heath Cling were employed. The results of the analyses at the different periods of development are given in tables. The season was abnormal, being very humid up to August 10 and very dry after August 20.

The data secured show that the peach contains practically no starch at any stage of growth. Between the time of the June drop and the market ripeness of the peach the weight increased on an average from 9.51 to 73.59 gm., the solids in the flesh from 0.9 to 9.72 gm., and the percentage of flesh from 64.55 to 92.49, while the weight of the stone decreased from 32.5 to 6.86 per cent of the weight of the whole peach. The proportion of solids to water in the flesh remains fairly constant throughout the whole period of growth. The stone, on the other hand, becomes harder and the percentage of water decreases.

The flesh of the peach increases in weight about eleven times between the June drop and market ripeness. The weight of reducing sugars increases nearly eight times, and sucrose and acids increase considerably more than this. The various forms of nitrogenous substances all increase in weight from the beginning to the end of the period of observation. Only 3 varieties of peaches were analyzed when fully ripe. Between market ripeness and full ripeness considerable growth takes place, there being an increase in both water and solid content and in reducing sugar and sucrose.

Studies on peaches, W. D. Bigelow and H. C. Gore (*U. S. Dept. Agr., Bur. Chem. Bul. 97, pp. 32*).—Part 1 of this bulletin is made up of compiled analyses of peaches; part 2 deals with the changes in chemical composition of the peach during growth

and ripening, and part 3 with the effect of storage on the composition of peaches. Part 2, dealing with the changes in peaches during growth and ripening, is noted above from another source.

In studying the effects of storage on the composition of market ripe peaches, one lot of fruit was kept at ordinary room temperature (77 to 86° F.), another in cold storage (32° F.), and a third lot in a common refrigerator (54 to 59° F.). By each method of storage the fruit lost weight, due not only to evaporation, but to actual decrease in the solids of the flesh. By storing at ordinary summer temperature marked changes occurred within 2 or 3 days.

The life of the peach can be prolonged only by reducing the temperature quickly after picking. Peaches stored at 32° F. changed much more slowly in composition. At the end of 3 or 4 weeks, however, the flesh may begin to discolor and there is a loss of flavor. The changes in the composition of peaches stored in a common refrigerator were intermediate between those stored at summer temperature and those in cold storage.

Besides the above experiments other data are given for the storage of very green peaches and of peaches taken when the stone was hardening These were placed in a common refrigerator at a temperature of 53.6 to 59° F. The results of these experiments on the whole were quite similar to those obtained when more mature peaches were stored in the ice box. "The rate of ripening of the green peach is not markedly more rapid than that of the more mature fruit."

Plums for home and market, W. J. GREEN and F. H. BALLOU (*Ohio Sta. Bul. 162, pp. 229–258, figs. 19*).—Directions are given for the planting and care of plums and descriptions of the sorts of European, Japanese, native, and hybrids that succeed best in the vicinity of the station.

The varieties described in each of these classes are arranged according to the season of ripening, beginning with the earliest, and the dates of blooming and period of ripening are noted in each case for the season of 1904. Many of the varieties mentioned are illustrated. In conclusion, a table is given showing in condensed form the classification and description of 107 varieties of plums grown at the station, with other data as to period of bloom, size and form of fruit, color, quality, etc.

Hybrids in their relation to grafting and wine, L. DANIEL (*Rev. Vit., 24 (1905), No. 606, pp. 89–96*).—The conclusions of the author are to the effect that there is a variation in vines which results from grafting, but this variation may be either useful or harmful.

The best varieties of French grapes can not be improved in quality by grafting, but may be rendered more resistant by this method. Hybrid grapes may be improved both in quality and resistance to Phylloxera by grafting. Variations produced by grafting appear frequently to be hereditary in vines. On this account the author advises the establishment by the government in the experimental fields now existing plats for the preservation of all the old French varieties as a means of comparison with future varieties and variations.

Analyses of American grape shoots, J. GÁSPÁR (*Ann. Inst. Cent. Ampélol. Roy. Hongrois, 3 (1905), No. 2, pp. 57–166, dgms. 9*).—Tables containing analyses of a large number of shoots of the varieties Portalis, Monticola, and Metallica of *Vitis riparia* and *V. solonis* are given with comments. The analyses show the size of the cuttings, water, dry matter, ether extract, and ash content.

The passion fruit, W. J. ALLEN (*Agr. Gaz. N. S. Wales, 16 (1905), No. 6, pp. 602–606, pl. 1, figs. 3*).—An account of the culture of this fruit in New South Wales, with a colored plate of the leaves, flower, and fruit, and illustrations of different vineyards which have been planted to it.

Notes on the growth and culture of vanilla, J. COSTANTIN (*Jour. Agr. Trop., 5 (1905), No. 48, pp. 163, 164*).—Mention is made of the rôle which fungi play in the development of orchids, more especially of vanilla, as an explanation of the practice

of planters in Réunion of tearing the vanilla vine from its living support at the time of flowering. The symbiotic relationship of vanilla and fungi has been previously noted (E. S. R., 16, p. 851).

In the author's investigations the period of flowering was considerably retarded in the presence of the fungus. By tearing the vine from its living support, therefore, the injurious effect of the fungus is minimized and this practice is given a rational explanation.

Vanilla culture in the Hawaiian Islands, A. INKERSLEY (*World To-Day, 9 (1905), No. 3, pp. 1012, 1013*).—An account of planting about 8,000 cuttings of vanilla in the region of Kona, Hawaii, where it is believed the climate is especially suitable for this crop.

A revised classification of roses, 1905, J. G. BAKER (*Jour. Linn. Soc. [London], Bot., 37 (1905), No. 258, pp. 70-79*).—A revised analytical key is given to the various groups of roses.

Our native orchids, W. H. GIBSON and HELENA L. JELLIFFE (*New York: Doubleday, Page & Co., 1905, pp. XXXVI+158, pls. 58, figs. 17*).—Illustrated descriptions with key are given of the orchids native to the region from Kansas east to southern Virginia and north to Manitoba and Labrador.

Ether forcing without a greenhouse, FLORA L. MARBLE (*Gard. Mag. [N. Y.], 2 (1905), No. 2, pp. 64, 65, figs. 7*).—An account of the etherization of 2 azaleas, 2 lilacs, and 2 deutzias in an old-fashioned chest and their subsequent growth in the living room of the house.

By etherizing these shrubs 72 hours from November 4, blooms were secured at Christmas time, the average cost of etherizing being 15 cents per plant. One azalea, Simon Mardner, 1 lilac, Charles X, and 1 deutzia were given a double dose of etherization with half the quantity of ether first used. This proved especially beneficial with these varieties, since the 1 deutzia etherized for only 72 hours failed to start into growth until late in the season, not producing bloom until February.

Two examples of grafts, L. DANIEL (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 3, pp. 214, 215*).—Tall morning glory (*Ipomœa purpurea*) and *Quamoclit coccinea* were grafted by the author on the sweet potato (*Batatas edulis*).

The first 2 are annuals, while the sweet potato in that climate is perennial, developing very slowly and producing tubers only at the end of several years. On the other hand, the 2 plants mentioned first are well adapted to the climate. As a result of these grafts tubers the size of 1 cm. were formed at the end of the first year, the tubers formed when *Q. coccinea* was used as a scion being smaller than when tall morning glory was used. The control sweet potatoes which had not been grafted produced no tubers.

In another instance *Helianthus multiflorus*, which is perennial and in that climate reproduces itself exclusively by tubers, was grafted on *H. annuus*, a variety of sunflower which grows well there, producing fertile seeds in abundance. As a result of this graft the *H. multiflorus* scion produced a large number of flowers, one of which contained a fertile seed. From this seed was grown an *H. multiflorus* which had conserved the characters acquired by the scion.

FORESTRY.

Forest irrigation experiments, K. BÖHMERLE (*Centbl. Gesam. Forstw., 31 (1905), No. 4, pp. 145-172, figs. 8*).—An account of irrigation experiments carried out near Vienna, Austria, during the years 1901 to 1904.

The forest was 56 years old in the beginning of the experiment and consisted of Austrian pine. Tables are given showing in detail the diameter growth of each of the trees on the irrigated and unirrigated plats during each year of the experiment. The increment percentages on the unirrigated plat during each year was as follows: In

1901, 2.3 per cent; in 1902, 5.2; in 1903, 4.5, and in 1904, 3.2. On the irrigated plat the increment percentage in 1901 was 5 per cent; in 1902, 7.4; in 1903, 7.1, and in 1904, 5.5.

These figures show an increased increment of about 10 per cent in favor of irrigation. The favorable effect of irrigation was noticed the first year, especially with the lower class trees.

Forest irrigation experiments, A. Cieslar (*Centbl. Gesam. Forstw., 31 (1905), No. 5, pp. 195–211, figs. 2*).—An account of irrigation experiments with young stands of white and Austrian pine and spruce during the period 1901 to 1904, inclusive.

From May to September of each year from 38 to 44 irrigations were given. The dates of each irrigation; the character of the year as regards precipitation, etc.; the number of trees which lived on the different plats, and the growth they made are all shown in detail. Irrigation proved especially efficient in the case of spruce. White pine seemed to be injured by irrigation except in the one very dry season of 1904, when marked results in favor of irrigation were noted. Austrian pine appeared not to be injured by irrigation in 1903, and was greatly benefited in 1904.

In other observations the author notes that Austrian pine withstands drought much better than white pine, and in dry situations should be selected for planting in preference to white pine.

The dead cover of forests and nitrogen, Hornberger (*Ann. Sci. Agron., 2. ser., 10 (1905), I, No. 2, pp. 220–230*).—The author briefly reviews the work of E. Henry (E. S. R., 16, p. 444) relative to the decomposition of dead leaves in forests and the fixation of atmospheric nitrogen, and gives the results of his own experiments conducted along the same lines.

The zinc boxes used in the author's experiments were 20 cm. square and 10 cm. deep. Holes were punched in the bottom so that water could escape and the bottom was covered with filter paper. Six of the boxes used contained a small amount of sandstone in the bottom. The leaves used in the experiment were those of oak, beech, pitch pine, ash, hornbeam, and acacia.

They were gathered in the fall and placed on screens and covered over with paper to keep the dust from them until they were needed in the experiment. Part of the leaves were then analyzed and the remainder put in their respective boxes and left in the open from February 6, 1903, to February 6, 1904, exposed part of the time to the rain and all of the time to the air. At the end of the year the leaves in all of the boxes were again analyzed with reference to their nitrogen content.

In all except 2 cases the total nitrogen content of the leaves had decreased instead of increasing, as was the case in Henry's experiments. Even in the 2 cases in which there was an increase the increase was so slight as to be within the limits of analytical error.

Observations on the preceding memoir, E. Henry (*Ann. Sci. Agron., 2. ser., 10 (1905), I, No. 2, pp. 231–236*).—The author reviews the above article by Dr. Hornberger on the decrease in nitrogen content of decayed forest leaves, and argues that the results of the experiments under the conditions in which they were conducted were not other than what might have been expected.

In gathering the leaves and allowing them to dry before the experiment began, the germinative ability of the micro-organisms originally existing on the leaves in the forest would be largely lost, and the material would therefore become nearly sterile and not able to function as normal dead leaves in the forest. In order to secure results of value it would be necessary to carry on the experiment under conditions exactly as they exist in large forests.

The recent work of a number of other investigators is cited to show that nitrogen-fixing bacteria really assimilate the free nitrogen of the air in the decomposition of forest leaves.

All the spruces worth cultivating, J. F. JOHNSTON (*Gard. Mag.* [*N. Y.*], *2* (*1905*), *No. 1, pp. 24–26, figs. 8*).—This is the second article in a series of monographs for the use of expert gardeners, designed to bring our knowledge of the subject up to date. It describes the various species of spruces, distinguishing their uses from a horticultural standpoint. A key to distinguish the spruces is included and illustrations given of a number of the more important species.

Productivity of Siberian larch, GUSE (*Centbl. Gesam. Forstw., 31* (*1905*), *No. 6, pp. 251, 252*).—Data on the height and diameter of trees in a Siberian larch forest established by Peter the Great in Finland. The trees vary in age from 80 to 164 years.

Mallet eucalypt bark better than black wattle, D. E. HUTCHINS (*Agr. Jour. Cape Good Hope, 26* (*1905*), *No. 6, pp. 784–789*).—Mallet bark is stated to be the produce of one of the West Australian gums, known botanically as *Eucalyptus occidentalis.*

In a comparison between mallet bark and black wattle, mallet bark contained 39.35 per cent of tannin matter, while black wattle contained but 35.96 per cent. The mallet eucalypt appears to be at home in the southwest of Cape Colony. A table is given showing the growth of 37 trees 2½ years from seed. The height varies from 2 to 11 ft. and the average is 6 ft. 6 in. The soil on which these mallet eucalypts are growing is declared to be too poor for most agricultural purposes.

Analysis of mallet bark (*Natal Agr. Jour. and Min. Rec., 8* (*1905*), *No. 6, pp. 578–580*).—Analyses with reference to the extract matter, tannin, nontannin, and moisture, are given for salmon gum (*Eucalyptus salmoniphloia*), gimlet (*E. salubris*), white gum (*E. redunca*), and mallet (*E. occidentalis*). The mallet appears to contain much the larger amount of tannin. The tannin of the salmon gum, however, is relatively more astringent than in the other barks tested.

Hedgerow timber, A. C. FORBES (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 3, pp. 129–136*).—This article considers hedgerow timber from the standpoints of ornamental gardening, wind-breaks, and as a natural source of wealth in rural districts, and contains suggestions on the planting, pruning, and management of hedgerow timbers.

Forest planting and farm management, G. L. CLOTHIER (*U. S. Dept. Agr., Farmers' Bul. 228, pp. 21, figs. 3*).—Reprinted with minor changes from the Yearbook of the Department of Agriculture for 1904 (E. S. R., 17, p. 147).

New source of rubber (*Mo. Consular and Trade Rpts.* [*U. S.*] *1905, No. 298, pp. 136–138*).—United States Consul Aymé reports that the India rubber exported from Para has been traced to 4 main sources: "India rubber proper from the *Hevea brasiliensis*, 'caucho' from the *Castilloa elastica* or a closely allied species—*Castilloa ulei*, 'maniçoba' from the *Manihot glaziovii*, and 'mangabeira' from the *Hancornia speciosa.*"

It appears that much of the rubber known as "fine Para," and which was supposed to be the exclusive product of *H. brasiliensis*, is really obtained from a tree identified as *Sapium aucuparium*. This tree has many native names, such as tapurú, murupita, curupita, etc. A prominent characteristic of the Sapium is its polymorphism. The same tree assumes widely different aspects under varying circumstances, such as sun, shade, dry ground, and wet or periodically inundated ground. The rubber from the tapurú tree it is claimed can not be distinguished from pure hevea rubber.

A rubber obtained from the upper Xingú River and which is known as "borracha fraca" or "weak rubber" closely resembles specimens of the murupita or tapurú rubber, and is believed by the author to be tapurú rubber. The Sapium appears to be a hardy tree and grows with great rapidity. A 5-year-old tree in the botanic gardens measured 8 in. in diameter 3 ft. from the ground. It is believed certain that the latex of this tree can be successfully mixed with hevea latex and be therefore of great commercial importance.

Rubber planting industry in Ceylon (*Jour. Soc. Arts, 53* (*1905*), *No. 2751, pp. 969, 970*).—There are at present about 25,000 acres under rubber cultivation in Ceylon,

the acreage having increased nearly 44 per cent during the past year. In the Malay Peninsula the extent of the rubber planting is placed at 30,000 acres, in Java at 5,000 acres, and in India and Burma at 5,000 acres.

Rubber in Hawaii, J. G. SMITH (*Hawaii Sta. Press Bul. 13, pp. 11*).—A brief account of American, African, and Asiatic rubber plants, with suggestions as to rubber culture in Hawaii.

The most suitable species for culture in Hawaii appear to be *Manihot glaziovii* and *Ficus elastica*. The first of these, it is stated, should comprise the larger proportion of all new plantations because of its very rapid growth and early maturity. *F. elastica* grows more slowly but yields much more abundantly when it finally reaches bearing age. Other promising sorts for Hawaii are maniçoba rubber (*Hancornia speciosa*) and the white rubbers (*Sapium tolimense*, *S. verum*, and *S. stylare*).

It is believed that conditions in Hawaii are very favorable for the cultivation of the Ceara trees. One company has already planted 100,000 seeds of this species and expect to have half a million trees growing within 2 years.

Results of tapping experiments in a Kickxia plantation, O. WARBURG (*Tropenpflanzer, 9 (1905), No. 7, pp. 385–390*).—An account of the tapping of Kickxia trees 5½ years old to determine the character of caoutchouc produced and the profitableness of working trees of that age.

The results obtained indicate that caoutchouc from trees of this age while not of the best has considerable commercial value. It is not believed advisable to systematically work trees of this age. In certain cases, however, tapping may be profitable. Thus one man can secure from 5 trees this age about 400 gm. of dry rubber per day having a market value of at least 38 cts., while the cost of production is about 18 cts. The experiment was preliminary to a more thorough investigation which is to be undertaken.

Estimate of cultivated rubber in the world (*India Rubber Jour., n. ser., 30 (1905), No. 5, pp. 259, 260*).—An account of the planting of rubber in Ceylon with an estimate of the acreage of cultivated rubber in the different countries of the world in 1905. The total acreage is placed at 149,950.

DISEASES OF PLANTS.

Notes on parasitic diseases of plants, F. BŒUF (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 35, pp. 245–269, figs. 16*).—A number of fungus diseases of cereals, fruit trees, vegetables, and ornamental plants are described, and where remedies are known suggestions are given for their use.

Attention is called particularly to the parasitic growth of a number of species of broom rape upon various vegetables, forage plants, etc. There are said to be 13 species of Phelypæa and 20 of Orobanche in Tunis that are known to be parasitic on various plants, the most of them occurring on vegetables. Constant care that the seed of broom rapes should not be included in seed of economic plants is urged.

Diseases of plants in the Tropics, G. DELACROIX (*Agr. Prat. Pays Chauds, 5 (1905), Nos. 29, pp. 164–173; 30, pp. 230–245*).—In continuation of previous papers (E. S. R., 16, pp. 676, 1091), the author gives a classification of parasites, describes the different forms of parasitism, and discusses the various causes of parasitic attack.

The invasion of the host plant by fungi is due to positive chemiotactic action, and facultative parasitism is also to be explained in this way. Immunity and predisposition to disease are determined by the chemical composition of the host. Slight modifications seem able to secure some degree of immunity. The effect of age of plants, soil, atmospheric conditions, etc., on disease is discussed.

A blight of barley and oats (*Jour. Bd. Agr. [London], 12 (1905), No. 6, pp. 347–350, figs. 2*).—A description is given of a blight of barley and oats caused by *Helminthosporium gramineum*.

The fungus produces upon the leaves and leaf sheaths minute, scattered, pale-green spots, which increase in number and size, and the leaf gradually changes to a sickly yellowish-green color, after which it ceases to grow. The plants attacked are checked in their development, and in bad cases the crop dries up without producing more than a small percentage of well-developed heads.

In addition to the hosts mentioned the fungus has been observed on wild barley, and it probably occurs on a number of wild grasses, from which it may pass to cultivated oats and barley. It is thought probable that the fungus may be conveyed by seed, and treatment with fungicides or hot water is recommended.

A preliminary note on clover diseases in Tennessee, S. M. BAIN and S. H. ESSARY (*Science, n. ser., 22 (1905), No. 564, p. 503*).—A preliminary report is given of investigations carried on at the Tennessee Station to ascertain the cause of several diseases of clover. In the vicinity of Knoxville this crop begins to die in the summer following late winter sowing, and the trouble has been popularly attributed to some condition of the soil. The authors' investigations have shown that the malady is independent of soil conditions, but is principally due to a specific fungus.

Early in the season the clover rust (*Uromyces trifolii*) and *Pseudopeziza trifolii* were both noticed upon clover, but were of comparatively little importance. A more destructive disease is that caused by *Macrosporium sarcinæforme*. This fungus attacks alsike clover as well as the red, and appears capable of destroying the plants without assistance from any other parasite. The most destructive disease thus far observed is due to an undescribed species of Colletotrichum. In general appearance this disease is said to resemble the anthracnose of clover, which has been attributed to *Glœosporium caulivorum* (E. S. R., 14, pp. 159, 773).

The Colletotrichum referred to causes considerable injury to young clover plants in early summer, where it confines its attacks to the petioles of the leaves. The greatest damage, however, is said to be to the blooming and fruiting plants, which are attacked most frequently just below the flowerheads, but sometimes at other points causing the blackening and death of a limited region, eventually destroying the entire plant.

The details of the investigations are to be published in a bulletin of the Tennessee Station.

Diseases of tobacco, M. T. COOK and W. T. HORNE (*Estac. Cent. Agron. Cuba Bul. 1, pp. 17-22, figs. 4*).—Descriptions are given of a disease of tobacco in the seed bed due to *Rhizoctonia* sp., the mosaic disease, the leaf spot caused by *Cercospora nicotianæ*, some curing house troubles, and the occurrence of a broom rape (*Orobanche ramosa*) in tobacco fields. Fungus diseases so far have not seriously threatened the crop in Cuba, but the author thinks best to describe those enumerated above, and suggests methods for their prevention.

The duration of Gymnosporangium and its relation to rusts, E. PRILLIEUX (*Bul. Soc. Nat. Agr. France, 65 (1905), No. 6, pp. 464-479*).—In investigating some of the heterœcious rusts the author has studied the phenomena relating to the Gymnosporangium on junipers and its Rœstelia stage or rust on pears and ornamental hawthorns.

All trees and shrubs carrying the so-called cedar apples should be cut out when in the vicinity of pears, apples, hawthorns, and similar plants. The Gymnosporangium is perennial in the tissues of various species of juniper, and it is known to persist for 4 to 8 years in the common juniper and 12 or more years in *Juniperus sabina*. The presence of either of these species of shrubs makes combating the rust on the pear and other economic plants all the more difficult.

The black spot, or scab, of the apple and pear, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 27 (1905), No. 2, pp. 169-174*).—Notes are given on the occurrence of the black spot, or scab, due to *Fusicladium dendriticum* and *F. pyrinum*. The distribution and amount of injury caused by these fungi throughout Australia is shown,

after which the author discusses the propagation of the fungi, methods by which they spread, etc.

Both apples and pears seem quite subject to attacks of these fungi in South Africa, and attention is called to the fact that while the regulations prohibit the introduction of apple trees for orchard planting there is no restriction against the introduction of seedlings for budding and grafting purposes, and it is thought that through these the disease is propagated and spread. Among the remedies suggested for the prevention of losses the author recommends the thorough application of Bordeaux mixture.

Fire blight, L. F. HENDERSON (*Wis. Hort. Soc. Bul. 5, pp. 8*).—This bulletin, which is a reprint of a press bulletin of the Idaho Experiment Station, gives a brief history and description of fire blight, together with approved remedies.

Black and gray rot in Indre, H. BLIN (*Rev. Vit., 24 (1905), No. 611, pp. 241, 242*).—During 1905 the black rot was especially destructive in the vineyards of Indre, the Lyonnais and Durif varieties being most attacked.

A commission composed of members of the viticultural society in cooperation with the departmental professor of agriculture have made a study of the situation, and for future treatments they recommend a winter treatment of iron sulphate 25 to 30 kg., sulphuric acid 1 liter, and water 100 liters. This is to be followed during the growing season by applications of a spray composed of water 100 liters, crystallized copper acetate 1 kg., and acetic acid 0.5 kg. The applications should be made with reference to the time of appearance of the rot.

For the prevention of the gray rot caused by *Botrytis cinerea* the application of a powder recommended by Zacharewicz is advised. This consists of plaster 60 kg. and sulphosteatite, containing 20 per cent copper sulphate, 40 kg., to be dusted over the vines at frequent intervals.

Treatment for Botrytis of grapes, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 19, pp. 561–566*).—Attention is called to the use of various mechanical treatments for preventing the attacks of *Botrytis cinerea* on grapes. These consist in the main of dusting the foliage with mixtures containing sulphur, lime, steatite, etc., often accompanied with Bordeaux mixture.

The author briefly describes experiments with fertilizers in which different rows of vines were treated with muriate of potash, calcium superphosphate, and nitrate of soda. The superphosphate appeared without effect as far as the disease was concerned, but the muriate of potash seemed to reduce the amount of disease, while those vines receiving the nitrate of soda were much more affected than any of those receiving treatment. As a supplemental treatment to the use of fungicides the author recommends attention to the fertilizers used. Where the disease is prevalent the amount of nitrogen should be diminished and potash increased.

It is claimed that the Botrytis is more severe after attacks of *Tortrix ambiguella* and the destruction of this insect is advised.

The rougeot of grape, L. RAVAZ and L. ROOS (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), Nos. 39, pp. 363–370; 40, pp. 392–398, pl. 1*).—This disease, which has long been known, makes its appearance in the summer whenever the heat becomes extreme.

The leaves become altered and lose their rigidity, and the parenchyma becomes reddened, while the principal veins remain green. Later the leaves become brown and dead, the grapes are wilted, and the young shoots yellow. The diseased vines do not die suddenly, but their productivity is considerably diminished. A microscopic study of the tissues does not show any exceptional characters beyond the increased quantity of the red coloring matter, anthocyanin, and a greater abundance of starches and sugars. Later in the season the young growth does not show this unusual coloring, and the old leaves still remaining resume their normal coloration.

Numerous causes have been assigned to this disease, but the evidence seems to show that it is due to impaired nutrition and that it may be artificially induced in a number of ways. It is believed that an insufficiency of lime is at the base of the trouble. Experiments with lime and other fertilizers show that the disease can be controlled, the best results being obtained where potash salts were used in conjunction with lime, the potash seeming to make the lime more readily available to the plant.

Acariosis, brunissure, and erinosis, H. Faes (*Prog. Agr. et Vit.* (*Ed. l'Est*), *26* (*1905*), *No. 31*, *pp. 133–146*, *pl. 1*, *figs. 6*).—Acariose, or "court-noué," brunissure, and erinose of the grape are, according to the author, all caused by *Phytoptus vitis*, the different appearances assumed by the host plant being due to differences in varietal susceptibility, weather, etc.

For treatment the use of sulphur, lysol, mixtures of soap and an extract of quassia, and soap and tobacco gave good results, the latter proving the most efficient. The summer treatments should be preceded by thorough spraying of the vines in February or March with rather strong solutions of lysol, soap and carbolic acid, and soap, carbolic acid, and oil of rape seed. Winter treatment with strong solutions of copper sulphate or iron sulphate would probably be found effective.

A disease of cherry laurel, E. Raignault (*Jardin*, *19* (*1905*), *No. 437*, *p. 140*, *figs. 3*).—An account is given of attacks of *Coryneum beyerinckii* on the cherry laurel, and it is said to also infect the peach, cherry, almond, and apricot.

For the prevention of the disease the author recommends several sprayings during the growing season with Bordeaux mixture. On the cherry laurel the fungicide is less adherent on account of the smooth surface of the leaves. When occurring abundantly this blotch destroys the ornamental value of these shrubs by causing their defoliation.

Report of the botanist, J. Burtt-Davy (*Transvaal Dept. Agr. Ann. Rpt. 1904*, *pp. 261–320*, *pls. 22*, *maps 5*).—In a report of the botanist for the year ending June 30, 1904, notes are given on a number of plants of economic importance, together with a record of investigations on stock ranges, noxious weeds, plant diseases, and plants poisonous and injurious to stock.

Among the diseases discussed particular attention is devoted to the coffee leaf blight due to *Hemileia vastatrix*. This fungus has almost devastated the coffee plantations in the districts examined. Attention is called to the fact that an indigenous species, *H. woodii*, is quite common on two South African shrubs, *Vangueria infausta* and *V. latifolia*. These two species of fungi are so closely related that it is believed that the indigenous species could readily attack coffee plants if opportunity was offered.

Notes on the use of combined fungicides, L. Augrand (*Rev. Vit.*, *24* (*1905*), *No. 606*, *pp. 105–107*).—In seeking a combined fungicide for use against the powdery and downy mildew of grapes, the author carried on experiments with a number of mixtures, and the results obtained are briefly given.

Sulphur in a dry state is said to act too slowly, and to obtain a more rapid liberation of sulphurous acid a number of mixtures were tested. Calcium bisulphite and sodium hyposulphite were each added to Bordeaux mixture at the rate of 500 gm. per hectoliter. Both mixtures badly burned the foliage and considerable injury followed their use even when diluted to a considerable extent.

Later the author tried a mixture composed of Bordeaux mixture and an alkaline polysulphid with success. The formula and directions for making this mixture are as follows: Copper sulphate 4 kg. and water 100 liters, polysulphid 2 kg. and water 100 liters, and lime 2 kg. and water 25 liters. After a thorough solution, pour the lime water into the polysulphid solution, and this mixture in turn into the copper solution, stirring thoroughly. This mixture is said to be very effective in preventing both forms of mildew, is quite adhesive, and acts as a stimulant to the foliage, as judged from the dark green color of the plants.

A study of combined fungicides, J. DE BOUTTES (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 24, pp. 716, 717*).—A favorable report is made of the addition of sulphur to Bordeaux mixture, the combination being applied at one spraying.

Three years' use of this mixture in comparison with sulphur applied in the ordinary way has convinced the writer of its efficiency. The combined fungicide is said to be much more adherent than the ordinary forms, and its greater efficiency is attributed to the fact that the sulphur is deposited much more uniformly over the foliage than is possible when dusted in the form of powder. The acid in the copper sulphate mixture is said to materially add to the adhesiveness of the mixture.

The crystallization of soda fungicides, F. PORCHET (*Rev. Vit., 24 (1905), No. 616, pp. 377–380*).—The chief difficulty in the use of soda fungicides is said to be due to their rapid deterioration. When solutions of carbonate of soda and copper sulphate are mixed, a colloidal precipitate of a greenish-blue color is formed. Ordinarily after standing for a little time the precipitate loses its blue color, becomes crystalline, and is less adherent to the foliage than when freshly made.

The causes of the changes were studied, and the author says that if properly made the solution should stand for a long time without crystallization. Too great acidity favors crystallization and alkalinity retards it, though too much alkali makes the fungicide thick and less adherent. High temperatures favor crystallization. The use of impure chemicals and utensils that have been used for other fungicides also favors the depreciation of the fungicide. On this account a warning is given that all utensils, spray pumps, etc., should be thoroughly washed before using them for the preparation or application of fungicides containing soda compounds.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The mammals of Great Britain and Ireland, J. G. MILLAIS (*London, New York, and Bombay: Longmans, Green & Co., 1905, vol. 2, pp. 299, pls. 72*).—In this, the second of the three proposed volumes relating to the mammals of Great Britain and Ireland, the author continues a discussion of carnivora including the family Mustelidæ.

The greater part of the volume is devoted to a consideration of the habits and economic relations of various rodents, including squirrels, beaver, rats, mice, and voles. The anatomy and habits of each species of mammal mentioned in the volume are discussed in great detail, so that the work furnishes a fund of information of unusual value regarding these species. The illustrations accompanying the volume are of excellent quality.

Game laws for 1905, T. S. PALMER, H. OLDYS, and R. W. WILLIAMS, Jr. (*U. S. Dept. Agr., Farmers' Bul. 230, pp. 54, figs. 6*).—This bulletin is similar in purpose to those issued annually on the same subject since 1902. The information contained in the bulletin is more condensed than in the previous issues and recent changes in game laws are included.

The destruction of gophers, ground squirrels, and prairie dogs, A. MERAZ (*Com. Par. Agr. [Mexico], Circ. 20, pp. 11, pl. 1*).—These pests are described with particular reference to the damage which they cause to cultivated crops. In combating them various poisons have been tested, including phosphorus, strychnin, and cynanid of potash. Traps, fumigation with bisulphid of carbon, acetylene gas, and other remedies were also tried. Good results were obtained from the application of fumigation methods.

The destruction of rats, G. GANDARA and C. MACIAS (*Com. Par. Agr. [Mexico], Circ. 22, pp. 44, figs. 39*).—The distribution and injurious effects of rats are briefly discussed. Particular attention is given to a consideration of remedies for destroying these pests. Among the remedies discussed by the author mention may be made of baits containing phosphorus, arsenic, strychnin, and other solid poisons, as well as

the use of bisulphid of carbon and other gases, flooding, and destruction with infectious virus. The use of various traps is also considered. According to reports bearing on the use of virus this remedy is of considerable efficacy.

The destruction of field mice, H. SAGNIER (*Bul. Soc. Nat. Agr. France, 65 (1905), No. 5, pp. 378–386*).—In the district of Haute-Marne, field mice disappeared quite suddenly, apparently as a result of abundant rains and heavy snows during winter. The weather was extremely variable during the months of January and February. It appears, therefore, that the mice were frozen or drowned in the burrows.

The study of birds, C. J. PENNOCK (*Ann. Rpts. Bd. Agr. Del., 3–4 (1903–4), pp. 54–58*).—The feeding habits and economic relations of birds are briefly discussed, with notes on certain species of importance from an agricultural standpoint.

Two natural enemies of the farmer. The value of birds to the farmer, T. G. PEARSON (*Bul. N. C. Bd. Agr., 26 (1905), No. 8, pp. 41–44*).—Brief reference is made to the losses caused by noxious weeds and insects. Birds are discussed as friends of the farmer on account of their assistance in destroying weeds and injurious insects. Particular mention is made in this connection of the quail, meadow lark, robin, cuckoo, chickadee, chipping sparrow, night hawks, etc.

Birds from certain of the Philippine Islands, R. C. MCGREGOR (*[Philippine] Bur. Govt. Labs. [Pub.], 1905, No. 25, pp. 34, pls. 11*).—Lists are given of birds observed on the islands of Romblon, Sibuyan, Cresta de Gallo, Ticao, Cuyo, Culion, Calayan, Lubang, and Luzon. Certain species are described as new and notes are given on the distribution and feeding habits of some of the more important ones.

The horned larks and their relation to agriculture, W. L. MCATEE (*U. S. Dept. Agr., Bur. Biol. Survey Bul. 23, pp. 37, pls. 2, figs. 13*).—Horned larks occur at least at one season of the year in all parts of North America except the Aleutian Islands, southern Alaska, extreme southeastern part of the United States, and Central America. Over this whole territory one species prevails with 21 named varieties or subspecies.

The discussion presented in the bulletin is based on an examination of 1,154 stomachs of horned larks from 25 States and Territories. This examination showed the contents to consist of 20.6 per cent animal and 79.4 per cent vegetable matter. The amount of animal matter present in the stomachs increases greatly in April and May. In general the feeding habits of the horned lark of Europe appears to be very much like that of this country.

In former times the horned lark constituted a food product in the United States, and was killed in large numbers. These birds were also preyed upon by various hawks, owls, and shrikes. The feeding habits of all varieties of horned larks are almost the same except those of the larks which occur in California, the chief difference being in the vegetable food consumed. In California grain constitutes 40.2 per cent of the food of the horned larks, while in the country outside of California grain formed only 12.2 per cent of the diet. This is perhaps due to the scarcity of insects on the dry ranges.

Considerable difference of opinion prevails regarding the economic relations of horned larks, some of the farmers considering them pests, while others consider that the losses caused by them are not of great importance. Oats is the most important grain food of horned larks, and in California this cereal grows wild to such an extent that the presence of oats in the stomachs of horned larks can not be considered against them.

The author believes that in California, where horned larks depend chiefly upon grain for food, they may do considerable harm. Elsewhere they are believed to be of much value to the farmer. The nestling horned larks are highly insectivorous, but soon after leaving the nest they become much more vegetarian than even the adult birds.

An apparatus for collecting small arthropods quickly and in large numbers, A. Berlese (*Redia, 2 (1904), No. 1, pp. 85–89, figs. 2*).—The apparatus described in this article depends for its effectiveness upon the application of heat to the material in which small arthropods are concealed.

Moldy soil or other rubbish is placed in a receptacle in the top of the apparatus, the material lying upon a metallic screen with small apertures. Beneath the metallic screen which holds the material to be investigated is a funnel leading to a small tube containing alcohol or other preserving fluid. The funnel is surrounded by water which may be heated to a suitable temperature. The heat gradually dries out the soil or other material in which the insects are hidden, causing them to crawl downward in search of moisture and in so doing they fall into the metallic screen and ultimately into the funnel.

Index-catalogue of medical and veterinary zoology, C. W. Stiles and A. Hassall (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 39, pts. 12, pp. 839–902; 13, pp. 903–950*).—In these two parts of the index-catalogue the authors present an alphabetical list of authors for the letter K.

Insects injurious to grain and fodder crops, root crops, and vegetables, J. Fletcher (*Canada Cent. Expt. Farm Bul. 52, pp. 48, pls. 8*).—The author presents, for the use of farmers and gardeners, a general account of the common insect pests which attack cereals, forage plants, fruit crops, and garden vegetables.

The most effective insecticides are described and formulas suggested for preparing them. Among the insects injurious to grain and fodder crops mention may be made of Hessian fly, jointworm, wheat-stem maggot, wheat midge, western wheat-stem sawfly, grain aphis, wireworm, white grub, corn worm, grasshopper, pea moth, pea weevil, bean weevil, destructive pea aphis, clover-seed caterpillar, clover-seed mite, army worm, etc. The common pests of root crops and garden vegetables are also described and notes are given on means of combating them.

Insects of Herm and Jethou, W. A. Luff (*Guernsey Soc. Nat. Sci. Rpt. and Trans. 1904, pp 374–390*).—The insects observed in these islands are listed and notes are given on the habits of some of the more important species.

The insect galls of Indiana, M. T. Cook (*Separate from Ind. Dept. Geol. and Nat. Resources Ann. Rpt., 29 (1904), pp. 801–871, figs. 52*).—This contribution to the knowledge of insect galls is to be considered a part of the author's proposed monograph of the insect galls of North America. The present contribution includes a discussion of galls observed on plants in Indiana.

The cotton-boll weevil, P. Marchal (*Jour. Agr. Trop., 5 (1905), No. 50, pp. 229–234*).—A historical account is presented of the origin and distribution of this pest and the early literature relating to it. The habits and life history of the insect are discussed with particular reference to the conditions which are favorable to its distribution. Brief notes are also given on some of the conditions which are unfavorable to the pest, and upon its natural enemies.

The cotton caterpillar (*Jour. Jamaica Agr. Soc., 9 (1905), No. 9, pp. 312–317*).—Apparently the caterpillar, which has recently done most damage to cotton in Jamaica, is the common cotton caterpillar of this country. The insect is described in its various stages and notes are given on its habits and life history.

As a result of a number of spraying experiments with Paris green and arsenate of lead it is recommended that arsenical poisons be thoroughly applied to cotton plants as soon as the caterpillars appear. In moderately dry weather this application can best be made in the form of a dry mixture with lime or some similar substance. In wet weather arsenate of lead dissolved in water is recommended.

Methods of combating the cotton-boll weevil and the cotton caterpillar, A. L. Herrera (*Com. Par. Agr. [Mexico], Circ. 24, pp. 2*).—Brief notes on the approved remedies for the control of these two insects.

The early history of the Hessian fly in America, F. M. WEBSTER (*Proc. Soc. Prom. Agr. Sci., 26 (1905), pp. 110–117*).—A historical discussion of the origin of the Hessian fly is presented, together with notes on the early outbreaks of this pest and its distribution (E. S. R., 16, p. 622).

Locust destruction, W. H. BUSHBY (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 6, pp. 559–562*).—The use of an arsenical solution as a spray for the control of locusts has proved very efficient and also harmless to cattle which may graze upon the grass. During the past year 5 tons of arsenical poison was purchased for this purpose and has yielded satisfactory results. While it seems impossible to exterminate the pest by this method it furnishes a means of holding the locust within reasonable bounds.

The destruction of white grubs in the district of Meaux, J. BÉNARD (*Bul. Soc. Nat. Agr. France, 65 (1905), No. 5, pp. 375–378*).—For several years a bounty has been offered varying from 10 to 20 centimes per kilogram of white grubs. In a period of 6 years a total of 462,911 kg. were thus captured. Estimating 1,200 white grubs per kilogram this would mean the destruction of about 500,000,000 of the larvæ. In order to carry on this kind of warfare against insects, however, it is necessary to secure large quantities of money as well as devotion to the work.

The habits and metamorphosis of Lebia scapularis, F. SILVESTRI (*Redia, 2 (1904), No. 1, pp. 68–84, pls. 3*).—This predatory beetle appears to be quite influential in the destruction of the elm-leaf beetle. The habits of *Lebia scapularis* are described in considerable detail with especial reference to the behavior and metamorphosis of the larvæ in different stages. An elaborate description is also presented of the silk-producing apparatus of the larvæ.

Invasion of bark beetles in Vosges, RIVET (*Bul. Soc. Nat. Agr. France, 65 (1905), No. 3, pp. 198–207*).—During the year 1904 *Tomicus typographus* and *T. curvidens* were unusually numerous and attacked fir and other related trees. The habits of these two species are described in detail. The extent of infestation and the amount of damage caused by these insects are briefly indicated.

A note upon the "bee-hole" borer of teak in Burma, E. P. STEBBING (*Calcutta: Supt. Govt. Printing, India, 1905, pp. 19*).—A considerable percentage of teak in Burma is injured by the presence of insect burrows to such an extent that it is useless for shipbuilding purposes.

The author investigated such timber for the purpose of discovering the cause and remedy. It was found that the burrows were produced by a moth identified as *Duomitus ceramicus*. The chief natural enemies of this moth are woodpeckers. In controlling the pest it is recommended that observations be made to determine the trees in which the insect is present. All infested trees should then be cut in the cold season and utilized in such a manner as to destroy the insects in all stages.

Observations and studies on hazelnut disease and means of combating it, A. TROTTER (*Redia, 2 (1904), No. 1, pp. 37–67, figs. 7*).—As a result of a thorough study of hazelnut trees, it was found that the so-called hazelnut disease may be due to a variety of causes. In some cases it is the result of infection with parasitic fungi such as *Phyllactinia suffulta* and related species. In other cases the disease is produced by attacks of *Heterodera radicicola*.

Hazelnuts may also be badly affected by infestation with mites, particularly *Eriophyes avellanæ*, or by the attacks of leaf-eating lepidoptera, coleoptera, or finally by infestation with scale insects and other insect pests. A brief bibliography of the subject is appended to the article.

The vaporer moth, W. FORBES (*Jour. Bd. Agr. [London], 12 (1905), No. 7, pp. 420, 421, fig. 1*).—*Orgyia antiqua* attacks various fruit and garden trees, as well as ornamental shrubs. The insect is described in its various stages with notes on its life history. In combating this pest the webs should be collected and burned and infested foliage should be sprayed with Paris green at the rate of 1 lb. per 200 gal. of water, or with arsenate of lead.

The gypsy moth, A. E. STENE (*Nature Guard, 1905, Lesson 42, pp. 173-176, pl. 1*).—Attention is called to the great damage done to forest and other trees by the gypsy moth. The life history of this insect is briefly discussed and recommendations are made regarding means for controlling it.

Mites in rubber nurseries, S. ARDEN (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 6, pp. 229, 230*).—In a case of infested rubber trees the young leaves fall before they are fully developed, as when attacked by red spider.

The mite causing this trouble appears to be a species of Tarsonymus. The disease is chiefly confined to plants under unfavorable conditions and does not commonly affect trees after they are thoroughly established. In one instance rubber trees were badly affected while suffering as a result of an insufficient supply of water.

The red disease of the grapevine and its treatment, E. ZACHAREWICZ (*Rev. Vit., 24 (1905), No. 618, pp. 447, 448*).—The disease discussed by the author is due to the attack of *Tetranychus telarius*. The appearance of this mite is discussed and notes are given on its habits. In controlling the pest, good results have been obtained by the use of a mixture containing 95 parts powdered live lime and 3 parts pyrethrum powder.

Report of the secretary of the American Mosquito Extermination Society, H. C. WEEKS (*Bayside, L. I.: Author, 1905, pp. 5, pl. 1*).—A study was made of the mosquito problem at Wellfleet, Mass. It was found that a swampy worthless area of about 2,500 acres in the vicinity of the town was badly infested with mosquitoes.

In the treatment of this marsh it is recommended that a dike be constructed for the purpose of preventing the entrance of tide water. It is believed that this will enable a better quality of grass to grow on the salt marsh so that the area may be profitable for farming. This will lead to the introduction of proper drainage systems which in turn will prevent the development of mosquito larvæ.

Lantern traps for noxious micro-lepidoptera, A. L. HERRERA (*Com. Par. Agr. [Mexico], Circ. 25, pp. 3, fig. 1*).—A brief description is given of a lantern trap which captured 24,492 insects in a single night when exposed in a cotton plantation in Texas. Among this collection of insects 13,113 belonged to injurious species. In the lantern a mixture was burned containing white pitch, turpentine, linseed oil, and olive oil.

Nursery fumigation, C. FULLER (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 6, pp. 533-540, figs. 10*).—The fumigation of nursery stock before delivery by the nurserymen is recommended as a good practice. For the nurserymen's use it is recommended that the fumigation house should be a permanent structure of wood, iron, or brick lined with gas-tight material located some distance from dwelling houses and subjected, at least once every six months, to a test of its gas-retaining power. Directions were given for the preparation and application of hydrocyanic-acid gas.

Experiments with fumigating nursery stock, T. B. SYMONS and A. B. GAHAN (*Maryland Sta. Bul. 105, pp. 11-34, figs. 5*).—The experiments reported in this bulletin were undertaken for the purpose of determining the effect of hydrocyanic-acid gas upon nursery stock. This remedy is believed to be the most reliable one for destroying San José scale on nursery stock and it, therefore, becomes important to determine whether or not the treatment is injurious to trees.

During the experiments 3,000 trees were treated, one-half in the fall and the other half in the spring. The fall treatment was given on October 15 and the spring treatment on April 7. Both peach and apple trees were used in these experiments and a detailed record of these experiments is presented in a tabular form. In some cases apparent injuries by the gas would perhaps be attributed to other agencies, such as unfavorable soil conditions after the trees were set out.

The amount of cyanid per cubic foot varied from below the usual quantity to 6 times the amount ordinarily recommended for fumigating nursery stock. One-half the

trees were fumigated in 30 minutes and the other half in 60 minutes. Where an excessive amount of cyanid was used in an exposure of 60 minutes several trees were killed by the gas. As a rule, however, the percentage of trees which died was no greater than is ordinarily the case in orchard planting.

In the fall experiments, peach trees appeared to be more resistant than apple trees. This was not true, however, in the spring work. Some varieties of apple, for example the Yellow Transparent, were more resistant than others. The authors conclude from these experiments that no injury occurs as a result of fumigating dormant apple and peach nursery stock 2 years or more of age with the usual strength of hydrocyanic-acid gas. Apparently fumigation in the fall with an excessive strength of cyanid is more likely to produce injury than in the spring.

Orchard fumigation with hydrocyanic-acid gas, C. FULLER (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 7, pp. 697–715, figs. 11*).—Detailed directions are given for the combination of chemicals to produce hydrocyanic acid, the use of tents and other apparatus for confining the gas, and the application of the method, particularly to citrus trees. The results of experiments along this line are briefly summarized and recommendations made in accordance with investigations already published in this and other countries.

Spray calendar (*Bien Rpt. Bd. Hort. Oregon, 8 (1905), pp. 49–74*).—The purpose of this as of other similar spray calendars is to make recommendations regarding the questions when to spray, what to spray with, and how to spray. Some of the more important insect and fungus pests are described for the information of fruit growers and standard insecticides and fungicides are suggested for the control of these pests.

Bee culture, J. S. GILFILLAN (*Ann. Rpts. Bd. Ag. Del., n. ser., 3–4 (1903–4), pp. 129–134, figs. 4*).—The social organization of bees is briefly discussed with notes on various bee products. The value of bees is considered from the standpoint of honey production and fertilization of fruits and other plants Brief directions are given for the care and management of bees.

Sericulture in Madagascar, E. PRUDHOMME (*Agr. Prat. Pays Chauds, 5 (1905), Nos. 25, pp. 311–325; 26, pp. 389–402; 28, pp. 50–65; 30, pp. 212–229, figs. 9*).—An elaborate review is presented of the present status of sericulture in Madagascar. Sericultural education is briefly discussed.

Detailed directions are given regarding the cultivation of mulberries of various varieties and their use in feeding silkworms. The diseases of silkworms are considered and notes are given on their insect enemies. A historical account is presented of the different races of silkworms and the comparative merit of races and various crosses. The influence of the selection in breeding silkworms is also briefly considered.

Diseases of the silkworm and means of combating them, G. GANDARA (*Com. Par. Agr. [Mexico], Circ. 21, pp. 16, figs. 8*).—The common diseases of the silkworm are described and notes are given on their economic importance and means of combating them.

FOODS—HUMAN NUTRITION.

Food adulteration in Arkansas, J. H. NORTON (*Arkansas Sta. Bul. 88, pp. 77–118*).—With a view to determining the extent of food adulteration in the open market the station has collected and examined 354 samples of canned vegetables and fruits, catsups, dairy products, jams and jellies, baking powders, vinegar, soda water sirups, etc. Of these 166, or 47 per cent, were adulterated or sophisticated.

The bulletin contains, in addition to the analytical data reported, a discussion of the importance of pure foods and what has been done to secure them, and also includes an article by R. R. Dinwiddie on preservative drugs found in foods, which discusses their physiological effect and similar topics.

Report of the State food commissioner of Illinois, A. H. JONES (*Ann. Rpt. State Food Comr. Ill., 2 (1901), pp. 258, figs. 8*).—This volume contains the report of

the State analyst, the report of the State food commissioner, a compilation of laws and rulings under the law, and other data connected with the food inspection work. The total number of foods examined, including spices, baking powders, cocoa, candies, flour, sirup, dairy products, etc., was 980, of which 338 or 37.5 per cent were adulterated.

Analyses of food products, W. W. P. McCONNELL (*Bien. Rpt. Minn. State Dairy and Food Comr., 10 (1905), pp. 142–328, 380–427*).—Details are given regarding the examination, under the provisions of the State pure-food law, of a large number of samples of baking powders, dairy products, jams, jellies, meats, flavoring extracts, milk and cream, etc.

Report of State chemist, J. HORTVET (*Bien. Rpt. Minn. State Dairy and Food Comr., 10 (1905), pp. 431–555, figs. 27, charts 3*).—The analyses made under the State pure-food law are discussed and data regarding court cases given. It is stated that 11,884 samples have been examined of which 3,756 were illegal.

Biennial report of the deputy food commissioner, W. F. THOMPSON and E. L. REDFERN (*Bien. Rpt. Deputy Food Comr. Nebr., 1904, pp. 53*).—Results of analyses of milk, vinegar, flavoring extracts, sirups, tomato catsup, cider, fruit products, canned goods, and a number of miscellaneous samples are reported and briefly discussed.

Nineteenth annual report of the Ohio dairy and food commissioner, H. ANKENEY (*Ann. Rpt. Ohio Dairy and Food Comr., 19 (1904), pp. 66*).—The report covers a year's work of the State dairy and food commission. The total number of samples examined was 2,394, of which 872 were adulterated or sophisticated. The samples examined included condiments, beverages, dairy products and other foods, spices, flavoring extracts, drugs, etc. Prosecutions were instituted on 132 adulterated articles.

The food inspector's handbook, F. VACHER (*London: The Sanitary Publishing Co., 1905, 4. ed., pp. 231, illus.; rev. in Lancet [London], 1905, II, No. 21, p. 1430*).—This volume is intended as a guide for the use of food inspectors and contains chapters on animal foods, fish, game, vegetables, etc., with a description of the appearance and character of the foods, so that those which are fit for food and those which should be condemned may be recognized. The question of food adulteration is also taken up.

The sanitary inspector's handbook, A. TAYLOR (*London: H. K. Lewis [1905], 4. ed., pp. 455, illus.; rev. in Lancet [London], 1905, I, No. 19, p. 1277*).—It is stated that this work has been thoroughly revised, illustrations have been added, and the text and index amplified. Various questions connected with sanitary inspection are discussed, and a synopsis is given of the public health laws of Great Britain. The book is designed to meet the needs of sanitary inspectors and those seeking to qualify for such appointments, and also to supply practical information to those interested in sanitary subjects.

Municipal food control manual, H. MESSNER (*Taschenbuch für die Lebensmittelkontrollorgane der Gemeinden. Vienna and Leipsic: Wilh. Braumüller, 1905, pp. 284; rev. in Österr. Chem. Ztg., 8 (1905), No. 10, p. 233*).—This volume is designed as a manual for those engaged in municipal food-control work.

Existing official laboratories and their utilization for the detection of food frauds and adulterations, A. C. GIRARD (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 7, pp. 847–853*).—A list is given of French official laboratories, which, in the author's opinion, can be made use of in an organized attempt to suppress food adulteration.

The detection of corn meal in sausage, H. KREIS (*Ber. Chem. Lab. Basel, 10 (1903); abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 8, p. 473*).—Methods of detecting corn meal were tested, the best results being obtained with that of Mayrhofer.

Analyses of imported Messina and New South Wales grown lemons, F. B. GUTHRIE (*Agr. Gaz. N. S. Wales, 16 (1905), No. 3, p. 306*).—Analytical data obtained from 5 samples are reported.

Properties and composition of some typical flours, W. E. MATTHEWSON (*Trans. Kans. Acad. Sci., 19 (1903-4), pp. 78-80*).—The composition of 8 sorts of flour and the character of the gluten were studied. Baking tests were also made but are not reported in detail.

According to the author, the baking tests showed that soft wheat flour gave a more sticky dough than the others, and this quality, more or less characteristic of soft wheats, "is considered to be connected with gluten rich in gliadin." The results obtained show that although the gliadin-glutenin ratio may be important in certain cases it did not suffice to explain the observed differences in the flours examined and that further study was needed regarding the relationships between composition and bread-making qualities.

The chemical composition and nutritive value of wheat and flour, CHAPUS (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 7, pp. 141-147*).—The gluten and gliadin content as a means of judging the quality of flour is discussed and data on the subject summarized.

The condition of starch in stale bread, E. ROUX (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 7, pp. 832-836*).—Since it had been found that when paste is allowed to stand the starch is changed into amylocellulose, an insoluble nonsaccharifiable material which colors iodin yellow, the author made investigations to learn whether a similar change takes place when bread grows stale.

The conclusion was reached that this was not the case and that it could not be said that the starch material of stale bread had a different nutritive value from that of fresh bread.

Poisonous bread, A. YACHEVSKI (*Zemledyeletz, 1905, No. 1, pp. 11-15; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 2, p. 249*).—Serious illness and sometimes death were noted in 1903 in various localities in Russia when bread was eaten made from local grown grain.

Ergot was found in some samples of grain and flour, but the poisonous properties were attributed to a fungus, *Fusarium roseum*. This fungus grows on rye in damp localities and wet seasons, and is apparently spread by rain, wind, and insects. Direct experiments made by Zhilyakov showed that the fungus would produce the poisonous properties noted in the bread.—P. FIREMAN.

Some causes of discoloration of canned mushrooms, J. SARTHOU (*Rev. Soc. Sci. Hyg. Aliment., 1 (1904), No. 7, pp. 853-860*).—Three sorts of discoloration were noted, namely, a darkened area, black specks of varying size, and a discoloration which extends to the whole of the can contents. The first and second are ascribed to chemical causes, and the last to the action of bacteria.

When mushrooms are sulphured and canned, the sulphurous acid, acting upon the metal of the can or upon the solder, may cause discoloration. Such chemical discoloration is regarded as harmless and, according to the author, may be remedied by soaking the mushrooms a short time in a weak solution of acetic, citric, or tartaric acid and washing in plenty of water. The bacterial discoloration is an accompaniment of putrefactive fermentation, and is characterized by the odor of hydrogen sulphid. Such canned mushrooms are unfit for use.

Concerning certain adulterations of lard, A. OLIG and J. TILLMANS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 10, pp. 595-597*).—Notes on a sample of lard adulterated with cotton-seed oil, flour, and paraffin.

The quality of commercial cream of tartar, L. D. HAVENHILL (*Trans. Kans. Acad. Sci., 19 (1903-4), pp. 66-68*).—The examination of a number of samples of cream of tartar sold in Kansas showed that a considerable proportion of the samples

purchased in grocery stores were adulterated with calcium acid phosphate and its accompanying impurities. In some cases little or no cream of tartar was present. The samples purchased from druggists were found to be pure.

Examining and judging ground black peppers, E. SPAETH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 10, pp. 577–595*).—A summary of data regarding pepper analyses.

Concerning the analysis of wine vinegar, A. FROEHNER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 6, pp. 361–363*).—The author concludes that lactic acid may be regarded as a normal constituent of wine vinegar and that a determination of the amount present may serve as a means of judging of the quality of the product.

Standards of purity for fermented and distilled liquors, P. SCHIDROWITZ (*Jour. Soc. Chem. Indus., 24 (1905), p. 176; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 6, Rev., pp. 352, 353*).—Various questions connected with standards of purity are discussed. The adoption of a single analytical factor as a standard of purity of any article is not considered advisable owing to the ease with which such a factor may be changed so as to come within requirements.

Sterilized fruits (*Jour. Jamaica Agr. Soc., 9 (1905), No. 1, p. 22*).—A note on the successful canning of mangoes, pineapples, bananas, akees, etc., by covering the fruit with cold sterilized water, sealing in bottles, and heating for 4 hours at 150° to 155° F.

The dietetic use of predigested legume flour, particularly in atrophic infants, D. L. EDSALL and C. W. MILLER (*Amer. Jour. Med. Sci., 129 (1905), pp. 663–684; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 6, Rev., p. 347*).—The data reported have to do with bean flour in which the starch is predigested by means of a diastatic ferment.

The diet in typhoid fever, J. B. NICHOLS (*Reprinted from Amer. Med., 9 (1905), No. 18, pp. 726–736*).—In this paper, based on the author's experience and that of others, a generous diet in typhoid fever is advocated. The results of a number of digestion and metabolism experiments reported by different investigators are summarized and discussed.

The use of copper in destroying typhoid organisms and the effects of copper on man, H. KRAEMER (*Amer. Jour. Pharm., 77 (1905), No. 6, pp. 265–281*).—On the basis of his own investigations and those of others the author recommends the use of small amounts of copper for the destruction of typhoid organisms in water, and states that he has obtained very satisfactory results by placing a piece of carefully cleaned copper foil 9 in. square in a vessel holding 3 to 4 qts. of water and allowing it to remain 4 to 8 hours. If the water contains a large amount of sediment, it is desirable to filter before treating with the copper foil. Such water has been used for over 6 months without any noticeable ill effects.

Believing that vegetables may be a source of typhoid infection, the author recommends washing those which are to be eaten raw in copper-treated water or placing them, especially lettuce and celery, in a vessel of water with a strip of copper foil and allowing them to remain from 2 to 4 hours with occasional agitation. "The use of copper vessels would be more convenient, but of course is more expensive."

Some of the author's general conclusions follow: "While exceedingly minute quantities of copper in solution are toxic to certain unicellular organisms, as bacteria, it is safe to assume that the higher plants and animals, including man, are unaffected by solutions containing the same or even larger amounts of copper. There being a number of factors which tend to eliminate copper from its solutions, it is hardly likely that there would be any copper in solution by the time the water from a reservoir reached the consumer if the treatment of the reservoir were in competent hands. Many plants contain relatively large quantities of copper, and when these are used as food some of the copper is taken up by the animal organism, but there are no records of any ill effects from copper so consumed."

The article contains a summary showing the amount of copper which has been reported in fruits, vegetables, and other food products, as well as bibliographical data on the subject.

Diet in health and disease, J. Friedenwald and J. Ruhräh (*Philadelphia and London: W. B. Saunders & Co., 1905, p. 689, figs. 4*).—In this volume, which the authors state is prepared to meet the needs of general practitioners, hospital internes, and medical students, and also to serve as a reference handbook for training schools, the chemistry and physiology of digestion are treated of at some length, as well as the different classes of foods, beverages, and condiments, and the concentration of food, the preservation of food, and other factors which bear upon diet.

Sections are devoted to infant feeding, diet for the aged, and other special conditions, etc., and special methods of feeding are discussed. More than half of the volume is taken up with discussions of diet in relation to disease and there is also a special section on institution dietetics and a short bibliography.

Nutrition and malnutrition, W. H. Allchin (*Lancet* [*London,*] *1905, I, Nos. 17, pp. 1111–1117; 18, pp. 1180–1184; 19, pp. 1250–1254; 20, pp. 1319–1326*).—A general summary and discussion of data on the digestion and absorption of different nutrients, and related questions under normal and abnormal conditions.

Standardized gruels, H. D. Chapin (*Med. Rec.* [*N. Y.*], *67* (*1905*), *No. 7, pp. 246–248, 275*).—In a paper presented before a meeting of the New York Academy of Medicine, January, 1905, the importance of gruels in infant and invalid dietetics is spoken of and directions given for the preparation of standard gruels of uniform composition.

Determinations of the total solids and protein in plain gruels made from barley, wheat flour, and rolled oats, and dextrinized gruels made from rolled oats and wheat flour are reported, the analyses having been made by the New York State Experiment Station. The author points out the high nutritive value of the vegetable proteids when given in the form of gruels. The paper was followed by a discussion.

The comparative influence of organic phosphorus compounds on nutrition, and the development and composition of animal tissues, A. Desgrez and A. Zaky (*Rev. Soc. Sci. Hyg. Aliment., 1* (*1904*), *No. 7, pp. 825–831*).—Experiments on animals were made with lecithin, nuclein, nucleic acid, and protylin, which led to the conclusion that these bodies increase the gains in body substance, especially protein, and favor rapid growth and the rapid accumulation of mineral matter in the skeleton.

The peptic cleavage products of the artolin, a proteid of wheat gluten, Hayashi (*Arch. Expt. Path. u. Pharmakol., 52* (*1905*), *No. 3–4, p. 289; abs. in Zentbl. Physiol., 19* (*1905*), *No. 4, p. 103*).—When treated for a short time with pepsin-hydrochloric acid, artolin yields an albumose-like body, "artose," which has the same composition as artolin, but a higher water content. When the action is continued for a longer time, parartose and metartose are obtained and the cleavage product artolin-antipeptone which contains no sulphur and 3 cleavage products of parartose containing sulphur, namely, protoartose, heteroartose, and deuteroartose.

Course of wholesale prices, 1890 to 1904 (*Bur. of Labor* [*U. S.*] *Bul. 57, pp. 389–549, dgms. 4*).—Food and food products constitute one of the groups included in the statistical investigation reported.

ANIMAL PRODUCTION.

Energy values of red clover hay and maize meal, H. P. Armsby and J. A. Fries (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 74, pp. 64, dgms. 3*).—Following methods outlined in an earlier report (E. S. R., 15, p. 1037), respiration calorimeter experiments were made with a steer in which 4 rations were tested in different periods.

The rations consisted of an amount of clover hay estimated to be somewhat less than sufficient for maintenance (5,200 gm.); a considerably smaller amount of clover hay (3,700 gm.); a small amount of clover hay (3,700 gm.) supplemented by a quantity of maize meal (850 gm.) calculated to be sufficient to make the total ration somewhat less than adequate for maintenance; and the same amount of clover hay supplemented by maize meal enough (4,000 gm.) to provide a ration sufficient for moderate gain.

The comparison between the first and second periods gives data for determining the net availability of the energy of the clover hay, and the results of the second and third periods for computing the energy of maize meal, while the data of the fourth period affords a means of ascertaining the percentage utilization of the energy of maize meal in the production of gain. Each experimental period covered 21 days, of which the first 11 were regarded as preliminary, and the digestibility of the ration and the income and outgo of matter and energy were measured.

From the experimental data, which are recorded in full, it appears that the coefficients of digestibility of the dry matter and total protein of the more abundant ration of clover hay were 59.13 and 48.58 per cent, respectively, and for the smaller clover-hay ration 59.70 and 53.19 per cent. In general, the smaller ration was more thoroughly digested, but the authors consider the differences small enough to be within the limits of error.

When maize meal formed a part of a ration scarcely sufficient for maintenance, the coefficients of digestibility of dry matter and protein were 87.34 and 85.23 per cent, respectively, and in the productive ration 91.50 and 62.30 per cent. The values for proteids in the 2 rations were 80.14 and 66.43 per cent. "The results obtained upon total protein and proteids seem to indicate a decrease in the apparent digestibility of these constituents under the influence of the large supply of carbohydrates in the maize meal."

In discussing energy values the authors point out that—

"The relation of the metabolizable energy to the amount of matter in the food may be expressed in terms of calories per gram of the total or of the digested organic matter. . . .

"The metabolizable energy of a feeding stuff may also be expressed as a percentage of the total or gross energy. Such a percentage is analogous to a digestion coefficient, so that if an average value for it were established for any particular kind of feeding stuff, the amount of metabolizable energy in a given amount of it could be computed from its total energy by multiplication by this coefficient just as the digestible dry matter or organic matter can be computed from the total amount present by the use of a digestion coefficient."

In the case of the clover hay it was found that the metabolizable energy constituted 42.58 per cent of the total energy in the first period, and 44.22 per cent in the second period, or 43.40 per cent on an average. Calculated as a percentage of the energy of digested matter, the values were 75.52 for the first period and 76.18 for the second period, or 75.85 per cent on an average. In the case of the maize meal the metabolizable energy was 64.16 per cent of the total energy on the limited ration and 77.68 per cent on the more abundant ration. When the calculations are based upon the energy of digested matter, the values are 75.06 and 85.53 per. cent, respectively.

"The above results represent what has been called the 'apparent' metabolizable energy. It is not at all unlikely that the addition of maize meal affected to a greater or less degree the digestibility of the hay to which it was added.

"In particular, . . . it seems possible that it diminished the digestibility of the protein of the total ration.

"If such was the case, the results . . . [noted] above are too small to represent the actual metabolizable energy of maize meal, just as the corresponding results upon the

digestibility of the protein are too small. In the one case as in the other our figures represent the net effect upon the amount of metabolizable energy or of protein which the animal derived from its ration. Any effect of one ingredient of the ration upon the digestibility of the other is ascribed, by the method of computation employed, entirely to the maize meal. The results, therefore, as stated, represent the apparent digestibility or the apparent metabolizable energy."

A considerable portion of the metabolizable energy of food, it is pointed out, may be consumed in the chemical and mechanical processes incidental to the digestion of food and its conversion into forms fitted to nourish the body, or may be otherwise converted into the form of heat and so not be directly available to make good the losses of potential energy from the body caused by the vital processes. The portion of the metabolizable energy remaining after deducting the quantity thus expended represents the net contribution which the food has made to the maintenance of the stock of potential energy in the body, and may be designated as net available energy. The average value deduced for red clover hay and the value for corn meal in a productive ration were 36.42 and 77.81 per cent, respectively.

"While this result is subject to the errors involved in the determination of the metabolizable energy of the maize meal, it is nevertheless evident that the energy of the latter is far more available than is that of either clover or timothy hay. Expressed in another way, this is equivalent to saying that the expenditure of energy in digestion and assimilation is relatively less in the case of maize meal -a result which was to have been anticipated from the nature of the material."

From the data presented, the authors calculate that the clover hay supplied 2,058 calories of the metabolizable energy per kilogram of total organic matter on an average and maize meal in a productive ration 3,441 calories. For available energy the calculated values were 750 calories per kilogram total organic matter for clover hay on an average and 2,678 calories for maize meal in a productive ration.

The authors' discussion of the differences between fuel value, values for maintenance, and productive processes, as exemplified by these experiments, has been noted from another publication (E. S. R., 17, p. 380).

Weathered hay, W. F. SUTHERST (*Chem. News, 92 (1905), No. 2385, p. 61*).—Part of a field of uncut hay was protected with canvas during 2 days of wet weather and samples of the protected hay and that which was not so protected were analyzed.

The dry matter of the protected hay had the following percentage composition: Water 15.65, protein 16.52, carbohydrates 39.14, crude fiber 28.91, and ash 5.43 per cent. The dry matter of the weathered hay had the following percentage composition: Water 12.75, protein 14.58, carbohydrates 37.14, crude fiber 33.32, and ash 4.96 per cent.

The larger proportion of water in the protected hay, in the author's opinion, is due to the fact that the gummy material in the hay, which would be the first to be washed out, is hygroscopic and attracts atmospheric moisture. The loss of nitrogenous material in weathered hay is not regarded as serious, since this material would largely consist of soluble nitrogenous bodies (amido compounds) whose feeding value is small.

Digestion coefficients of alfalfa, H. G. KNIGHT (*Ranchman's Reminder, 2 (1905), No. 5, pp. 36–39, fig. 1*).—In experiments with sheep carried on at the Wyoming Experiment Station the following average coefficients of digestibility were obtained with second cutting alfalfa: Dry matter 63.4, protein 79.7, fat 41.1, nitrogen-free extract 74.2, crude fiber 44.6, and ash 56.2.

Condimental stock and poultry foods, J. B. LINDSEY ET AL. (*Massachusetts Sta. Bul. 106, pp. 24*).—The results of chemical and microscopical examinations of 65 samples of stock foods, poultry foods, and condition powders are reported, the goods being secured in most cases from fresh stock and unbroken packages.

The basic ingredients of these materials were generally such well-known concentrated feeds as corn meal, wheat offal, and linseed meal, though in some instances some substance like mustard hulls was used. The medicinal ingredients were found to consist of some of the more common drugs, including fenugreek, fennel, anise, gentian, ginger, pepper, salt, magnesium and sodium sulphates, saltpeter, sodium bicarbonate, sulphur, iron oxid, charcoal, and turmeric.

The wholesale cost of the mineral drugs, except niter, it is pointed out, is not over a cent a pound, while that of the vegetable drugs varies from 3 to 12 cts. a pound, and judging from available data the original cost of the entire mixtures could rarely have exceeded 2.5 to 3 cts. per pound and in many cases could not have been over 2 cts. The retail price of the stock and poultry foods varied from 6 to 25 cts. a pound, depending on the brand and quantity purchased. The condition powders were much higher, ranging from 30 cts. to $1 per pound. The great economy of homemade mixtures of common drugs, etc., is pointed out.

The food value of stock foods and condition powders "has been shown to be no greater than that of the ordinary grains of which they are largely composed. Their medicinal value depends largely upon the aromatic seeds and roots used as a tonic for the stomach, on charcoal as an absorbent, and on the purgative effect of the Epsom or Glaubers salts. The quantity recommended to be fed daily is usually so small (1 oz. or less) that very little effect can be expected unless the material is fed for a considerable length of time. While it is probably true that some of these stock foods may prove beneficial under certain conditions, it is also true that most of them are heterogeneous mixtures and evidently put together by parties quite ignorant of the principles of animal physiology, pathology, and veterinary medicine."

A résumé of experiments with stock and poultry foods is also given, and the results of a demonstration test of the relative value of Pratt's food and a mixture of corn meal and wheat middlings is reported. Four cows, divided into 2 lots of 2 each, were fed a basal ration of fine-cut hay, rowen, distillers' grains, and middlings. In addition, one lot was given daily 0.5 to 0.75 lb. each of Pratt's food, and the other a like amount of the grain mixture mentioned. After a month the special rations were reversed.

Considering the test as a whole, there was a gain of 12 lbs. on the ration containing Pratt's food and 20 lbs. on the mixture of corn meal and wheat middlings. The total milk yield of the 2 lots was 3,048.2 lbs. and 2,998.07 lbs., respectively. With Pratt's food the milk showed on an average 13.51 per cent total solids and 4.58 per cent fat, and on corn meal and wheat middlings 13.45 per cent total solids and 4.54 per cent fat.

According to the authors, the investigations show that Pratt's food did not substantially increase the quantity of milk and milk ingredients over that produced by a like amount of ordinary feeds, as the slight variation noted was within the limits of experimental error. The condimental feed also failed to increase the richness of the milk, although it increased the cost of milk and butter fully 10 per cent. No effects, favorable or otherwise, on the general health and condition of the animals were noticed when the condimental feed formed a part of the daily ration.

The bulletin also contains brief notes of the examination under the law of 481 samples of concentrated feeds collected during the winter and spring of 1905. Though the analyses are not reported in full, some general deductions are drawn. Among other points it was noted that the cotton-seed meal was quite generally of good color and of satisfactory mechanical condition, though in many instances there was a tendency to reduce the minimum protein guarantee to 41 per cent or lower, which would indicate that the highest grade meal was not being offered. Several samples of Sea Island cotton-seed meal contained only 25 per cent protein, and consequently would be actually worth only about half the price of goods of prime quality.

Many of the wheat by-products examined were found to contain an undue amount of screenings and quite often corn, the amount of the latter being from a trace to some 30 per cent. Inferior wheat was also sometimes found. The molasses feeds usually met their guarantees, but the authors do not consider them to be as economical as high-grade protein by-products. The data regarding the poultry feeds examined were included in a bulletin previously noted (E. S. R., 16, p. 903).

Analysis of commercial feeding stuffs sold in Maryland, H. B. McDonnell et al. (*Md. Agr. Col. Quart., 1905, No. 28, pp. 11*).—Under the provisions of the State feeding-stuff law analyses were made of blood meal, meat meal, and similar goods, cotton-seed meal, linseed meal, flaxseed meal, granulated milk, gluten meal and feed, malt sprouts, corn-oil-cake meal, mixed and proprietary feeds, poultry feeds, bran, cotton-seed feed, dried molasses beet pulp, and dried sugar beet pulp.

The nutritive value of dried grape pomace, S. Weiser (*Weinlaube, 1904, pp. 453–455; abs. in Centbl. Agr. Chem., 34 (1905), No. 3, pp. 190–192*).—Analyses of dried grape pomace are reported and its feeding value discussed.

Phosphate of lime in the feeding of farm animals, J. P. Wagner (*Jour. Soc. Cent. Agr. Belg., 52 (1905), No. 8–10, pp. 268–281*).—From a summary of available data the conclusion is reached that the importance of phosphate of lime for the formation of bone and for the digestion and assimilation of food is generally recognized. Under ordinary circumstances the rations fed supply a sufficiency of this material. If, for any reason, this is not the case and mineral salts must be resorted to precipitated calcium phosphate of known purity should be used.

Present methods of beef production, III, H. W. Mumford and L. D. Hall (*Illinois Sta. Circ. 91, pp. 4*).—Information regarding pigs following cattle in the feed lot is summarized, the data as in the case of previous publications (E. S. R., 16, pp. 805, 1112) being based upon replies received from a large number of Illinois cattle feeders in answer to a circular letter of inquiry.

Of the 509 cattle feeders who furnished data on the subject, 90 per cent kept pigs with cattle when on feed, and 70.7 per cent of those who stated a preference as to breed favored Poland-Chinas. Whatever the breed, pigs 6 months old or those weighing on an average 125 lbs. were generally preferred, and 56 per cent of the feeders allowed 1 pig to each steer. Eighty-three per cent of those who keep pigs with their cattle fed corn in addition to the feed which they could gather. Nine per cent of the correspondents who replied stated that they secured less than 1 lb. of gain per head per day when no additional corn was fed to the pigs, 42.5 per cent secured a gain of 1 lb. per head per day, and 49 per cent more than 1 lb. With reference to the proportion of the corn fed to the cattle which should be charged to the pigs following them, three-fourths of the correspondents stated that one-fifth to one-third should be charged to the pigs.

Oil meal when fed to steers is often said to have a beneficial effect on the pigs following them. Thirty-seven per cent of those who furnished data on this point noted an advantage, while the remaining 63 per cent did not. Forty per cent of the feeders had found that cotton-seed meal fed to cattle is injurious to the pigs following them, while 60 per cent had noted no injurous effects. A small number of the correspondents mention other supplementary feeds (usually condimental stock feeds) which, in their opinion, have given as good results as oil meal.

"One of the most successful feeders states in his report that he has used successfully a self-feeding box in supplying mineral substances to the hogs. Wood ashes are mixed by the wagonload with salt, copperas, and sulphur, and placed in a small self-feeder similar in construction to those used for cattle."

Only 8 per cent of the correspondents furnish permanent houses for their pigs, while practically all the remainder furnish no shelter except that afforded by the sheds and barns provided for the cattle.

Present methods of beef production, IV, H. W. MUMFORD and L. D. HALL (*Illinois Sta. Circ. 92, pp. 8*).—Continuing the above-mentioned work, information was collected regarding feeds and their preparation.

As regards the production and purchase of feeds, only about 10 per cent of the feeders who replied raise all the feed which they use in the production of beef. About 50 per cent purchase corn and 50 per cent other commercial feeds, linseed-oil meal being the most important feed besides corn.

As regards the methods of feeding the corn crop, 24 per cent of the 197 replies on this point were in favor of shock corn, 25 per cent in favor of shock corn combined with corn otherwise prepared, 13 per cent in favor of shredded corn and corn otherwise prepared, and 11 per cent in favor of shredded corn fodder alone.

"Eighty per cent either pasture the stalks in the field or cut part for shock corn and pasture the remainder, 12 per cent plow under all the stalks, and the remainder either burn them or convert them into silage. Only 5 correspondents state that they cut the entire crop of corn."

Linseed meal was fed by 21 of those who supplied data, the highest amount mentioned being 6 lbs. per head per day and the lowest (for young cattle) 0.2 lb. The average for all kinds of cattle was 2.2 lbs., and for fattening steers 3 lbs. Ten per cent of the replies mention the use of bran, 5 lbs. per head per day being the average amount, 13 lbs. the maximum, and 1 lb. the minimum. Cotton-seed meal was fed by 7 per cent of the correspondents, the largest amount being 9 lbs. and the smallest 1 lb. per head per day, or an average of 4.1 lbs. Only one correspondent spoke unfavorably of it.

The data gathered indicate that condimental preparations or "patent stock foods" are purchased by 7 per cent of the Illinois cattle feeders. "The advantages claimed for them by those who comment on the results secured are that they increase the amount of feed consumed, aid digestion, and give gloss to the hair. A large proportion of those who buy such preparations use them only for young stock or breeding cattle."

Oats are used by only about 3 per cent of the feeders, and various other grains and concentrated feeds, viz, gluten meal, gluten feed, hominy hearts, "shipstuff," cottonseed hulls, shorts, middlings, flaxseed meal, and brewers' grains are used by about 9 per cent of all the correspondents.

Data were also gathered as to the kind of coarse fodder used in full feeding, the kind of pastures preferred, their management, amounts of pasturage required, use of salt, practice of warming drinking water in winter, and related topics.

"Summarizing the reports concerning the daily gain in weight of cattle during the whole grazing season on grass alone, we find the average of all replies for 2-year-old cattle to be 1.87 lbs. per day. The greatest daily gain reported is 3 lbs., and the smallest 1 lb., but 80 per cent of the reports name amounts from 1.5 to 2.5 lbs. The average of all replies for yearlings is 1.66 lbs. per day. The greatest gain mentioned is 3 lbs., and the smallest 1.5 lbs."

Present methods of beef production, VI, H. W. MUMFORD and L. D. HALL (*Illinois Sta. Circ. 98, pp. 15, figs. 9*).—Continuing the summary of data based on replies received from some 500 cattle raisers (E. S. R., 17, p. 384), the importance of shelter and the need of improvements in feed lot conditions are considered.

The replies received from cattle raisers indicate that only a very small percentage have naturally drained lots or take any precautions to prevent mud and its attendant discomfitures and disadvantages. Of the 36 cattle feeders who report definite provisions against mud, 10 have paved or otherwise artificially covered the surface of the feed lot; 15 use rock, gravel, cinders, bricks, planks, corn cobs or sawdust, alone or in combination, in various parts of the lot, for instance, about the feed troughs, water tanks, sheds, or gates; 10 have put the lots in satisfactory condition by tiled draining, while 2 grade the yards and clean out the mud and manure with dirt

scrapers. Several of those who use coal cinders for filling muddy portions of the lot state that they should be covered with straw, cornstalks, or other bedding material in order to prevent injury to the feet of the cattle.

The authors note the wide divergence of opinion among practical feeders as to the kind and amount of shelter necessary for fattening cattle. About half the correspondents state that sheds are used; about one-third, including most of those who feed in spring and summer, use pens, lots, or open fields, where cattle usually have access to shade of one sort or another; and about 10 per cent feed in barns. Two individuals state that they practice stall feeding, while a few depend upon woods and straw stacks for shelter.

A few feeders report that they find the shelter unnecessary even in winter. Two-thirds of the correspondents stated that in their opinion better results would be obtained if the steers had access to a closed shed or warm barn and in many cases point out that the barn or shed should be well ventilated and lighted, and that the steers must not be confined too closely. Twenty-eight of the reports, principally those from large feeders, state that self-feeders are used and practically all who discuss the advantages of this plan of feeding point out either the saving of labor or the advantage of uniformly regulated feed.

The circular also contains brief descriptions of cattle yards, feeding and watering devices, cattle shelters, and a self-feeder which experience has shown to be satisfactory.

Flaxseed for fattening lambs, G. E. MORTON (*Ranchman's Reminder, 2 (1905), No. 3, pp. 19, 20, figs. 2*).—In a comparison of ground flaxseed and barley fed with alfalfa and turnips to lambs, it was found that on flaxseed the average gain in the 16 weeks of the test was 26 lbs. per head and on barley 33 lbs. The cost of a pound of grain was, however, greater on the barley than on the flaxseed ration.

The test as a whole is regarded as satisfactory since it shows that "raw flaxseed may be used successfully without cereal grains or corn in finishing lambs for market." Apparently flaxseed increased the flow of urine, as has been thought to be the case. The manure, however, was not of abnormal consistency.

Bacon pigs in Canada, J. H. GRISDALE (*Canada Cent. Expt. Farm Bul. 51, pp. 61, pl. 1, figs. 4, dgms. 8*).—Breeds, housing, feeds and feeding, care and management, causes of soft pork, and related questions are discussed, the work as a whole summarizing the investigations of the Canada experiment stations, particularly the Central Experimental Farm.

Very good results are reported from Manitoba when sows and breeding stock generally were wintered in pens constructed of a low framework of poles on posts covered with a large amount of straw, the entrance on the south side being a passage of similar construction to the pen. The pigs were, of course, fed outside the pens. It is said that with a temperature of 30° F. below zero the pigs remained in good health.

The various investigations which are summarized have been noted from time to time as they have appeared in the publications of the Canada experiment stations.

The effect of body movement upon the digestion and absorption of nutrients in the horse, A. SCHEUNERT (*Arch. Physiol. [Pflüger], 109 (1905), No. 3-4, pp. 145-198*).—The horses were fed under uniform conditions. In some of the tests they were allowed to rest for 1 to 5 hours after feeding, and in others they were driven for like periods. They were then slaughtered and the contents of the digestive tract examined with a view to determining the effect of muscular work on digestion and assimilation of nutrients.

In general, the conclusion was reached that body exercise considerably increased digestion and assimilation of the nutrients of food. The passage of stomach contents into the intestine begins very soon, probably while the food is being eaten, and is accelerated by exercise. Exercise increases the amount of gastric juice, and also its enzym and hydrochloric-acid content.

The daily ration of work horses, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 10 (1905), No. 36, pp. 297, 298*).—The changes which have been made in the rations of the Paris Omnibus Company's horses, the average value of the rations, and related topics are briefly spoken of. (See E. S. R., 16, p. 587.)

Examination of horses for soundness, G. H. ROBERTS, edited by A. W. BITTING (*Indiana Sta. Bul. 109, pp. 35–76, figs. 34*).—In this bulletin, which is the result of joint work between the State veterinarian and the station, the object has been to give concise and clear directions for the systematic examination of horses, to point out conditions that should be present in soundness and the diseases and defects that may be looked for in different parts of the body, and to call attention to vices which may be expected.

Different parts of the body are described, and the explanations and suggestions given are exemplified by numerous reproductions of photographs. The bulletin as a whole is designed to supply useful information to those who desire to purchase horses for various reasons.

"The horse is sound when he is healthy and when his conformation is such that he has not had and is not likely to have any tendency to any particular diseases. . . .

"An animal may have had diseases that have been cured, or may have some disease at the time of examination that does not interfere with his usefulness for some purposes, is then said to be 'serviceably sound.' In some places 'serviceably sound' refers only to wind.

"A vice is not necessarily unsoundness, but some of them lead to unsoundness and may therefore be considered as part of the examination in the selection of an animal. Vices are such traits of character, or such habits as have the tendency to produce disease or to lessen the usefulness, mar the appearance, interfere with, or make dangerous, the handling, or cause the destruction of property. Before examining the horse, the purchaser should decide upon the character of the service for which the animal is intended, whether for slow draft, heavy or light harness, saddle, or combination. The class or type, size, age, gait, sex, and color should be approximately settled. Ample time should be taken in the selection of a horse. This can usually be done when the animal is obtained from the dealer or producer, but is seldom allowable at public sales or at sale stables. . . .

"The ideal conditions under which to examine the horse for soundness is at his home, first in the stable, next in the door, then outside the stable, and finally in action."

DAIRY FARMING—DAIRYING.

Distillers' dried grains v. cotton-seed meal as a source of protein, H. P. ARMSBY and A. K. RISSER (*Pennsylvania Sta. Bul. 73, pp. 11*).—In an experiment with 12 cows lasting 12 weeks a grain ration of 3.5 lbs. of corn meal and 5.5 lbs. of distillers' dried grains was compared with a ration of 6 lbs. of corn meal and 3 lbs. of cotton-seed meal.

The dried distillers' grains resulted in a slight increase in the yield of milk and a marked increase in the fat content of the milk, but was more costly than the cotton-seed meal ration at the prices assumed. The quality of the butter produced on the distillers' grains ration was inferior to that of the butter produced on the cotton-seed meal ration.

Report of the experiment station and dairy institute at Kleinhof-Tapiau, 1904–5, HITTCHER (*Ber. Vers. Stat. u. Lehranst. Molkw. Kleinhof-Tapiau, 1904–5, pp. 12*).—In this account of the work of the institution during the year are given the records of the dairy herd of about 120 cows. The average composition of the milk of the herd for 10 years was as follows: Fat 3.181, total solids 11.728, and solids-not-fat 8.547 per cent. The corresponding figures for the year were 3.145, 11.787, and 8.642.

Possibilities of profitable cows on the farm, A. J. GLOVER (*Ann. Rpt. Ind. Dairy Assoc., 15 (1905), pp. 56-66*).—This summarizes the results of farm tests of 10 dairy herds. Of 145 cows of which records for 2 years were obtained, the best cow produced 7,190 lbs. of milk and 428 lbs. of butter, and the poorest 4,560 lbs. of milk and 158 lbs. of butter. Somewhat detailed reports are given of two of the herds.

Investigations on the fat-free solids in fractional milkings, F. LAUTERWALD (*Milchw. Zentbl., 1 (1905), No. 9, pp. 385-400*).—The author discusses the data published by Swoboda (E. S. R., 16, p. 71) and others and reports original determinations.

When calculated in percentages of the fat-free milk or milk serum, the solids-not-fat were found in the great majority of cases to be constant in the different portions of the milking. The variations in the constituents of the solids-not-fat (casein, albumin, milk sugar, and ash) were of an unessential nature and, from a practical standpoint, entirely insignificant. The hope of obtaining by means of fractional milking a milk more nearly approaching human milk in composition, as, for instance, one richer in albumin, is, therefore, considered entirely without foundation.

On the relations between the method of milking and the composition of the milk, F. KRULL (*Mitt. Landw. Inst. Leipzig, 1905, No. 7, pp. 107-180*).—The literature of this subject is reviewed and original investigations are reported in detail.

Relations between the method of milking and the composition of the milk were found to exist only so far as the fat content of the milk from the different quarters of the udder was concerned. The percentage of the other milk constituents remained practically constant. Any increase in the yield of milk and fat by any particular method was considered only apparent, since lower results were obtained by the succeeding method employed.

Variations in the fat content of the milk observed when different methods were used were believed to be due to purely mechanical causes, principally the contractility of the udder, the amount of agitation, and changes in tension due to the removal of milk. Variations in the fat content of the milk bore no constant relation to the method of milking employed.

Sampling milk for composite tests of individual cows, H. A. HOPPER (*Illinois Sta. Circ. 90, pp. 5, fig. 1*).—Directions are given for this purpose.

The value of the nitrate reaction for detecting the adulteration of milk with water, J. ADORJÁN (*Ztschr. Landw. Versuchw. Oesterr., 8 (1905), No. 9, pp. 846-851*).—Observations on this subject are reported from which the author concludes that the nitrate reaction can not always be depended upon as an indication of watering, inasmuch as the presence of dirt in milk may give the reaction.

It may also be obtained when the milk cans are washed and not dried before using. Furthermore the addition of water free from nitrates can not be detected in this way. The method, therefore, can not be depended upon to give more than a suspicion of the existence of adulteration which should be confirmed by more accurate analytical data. The method is, therefore, suitable for use only by the analyst in connection with other methods.

On bodies in normal and pathological milk serum which react with β-naphthalin-sulphochlorid, R. STRITTER (*Milchw. Zentbl., 1 (1905), No. 10, pp. 444-447*).—The author was unable to identify positively the presence of an amino compound or a body reacting with β-naphthalin-sulphochlorid in the serum of normal milk, although it was considered probable that such a nitrogenous substance may have been present in extremely small quantities. Further experiments with the milk of diseased animals are in progress.

Investigations on the determination and the variation of casein in human milk, G. PATEIN and L. DEVAL (*Ann. Chim. Analyt., 10 (1905), No. 11, pp. 422-427*).

Determination of dirt in milk, H. WELLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 10, pp. 591-596*).—The method used by the author consists in diluting 50 to 100 cc. of milk with an equal quantity of hot distilled water, filtering through a

weighed filter paper with the aid of a vacuum pump, and washing and drying the residue. This method was found to be rapid and accurate, comparing well with the methods of Renk and Stutzer.

Infantile mortality and milk depots, W. J. THOMPSON (*Dairy, 17 (1905), No. 203, pp. 352, 354*).—In this address statements are made concerning the success obtained by the Gouttes des Lait in France, and the infants' milk depots in England and other countries, and the establishment of such an institution in Dublin is urged.

The action of formaldehyde in the preservation of milk, F. D. CHESTER and T. R. BROWN (*Delaware Sta. Bul. 71, pp. 36*).—The questions studied included the effect of adding different proportions of formaldehyde to milk on the time required for the milk to sour, the number of colonies developing on agar plates, and the character of the bacterial flora.

The authors review briefly some of the literature of this subject, discuss the use of formaldehyde as a milk preservative, and from the experimental data presented draw conclusions which are quoted in full below. It may be noted that, as acknowledged by the authors, the position taken in the bulletin, as regards the use of formaldehyde in milk, is contrary to that generally held by medical men and sanitarians. To control bacterial development in milk by refrigeration is believed by the authors to be impracticable or too expensive at the present price of the product. It is predicted that about all that will ever be accomplished in controlling the milk supply will be the control of the more glaring abuses regarding production and handling.

Where an intelligent person is his own producer and consumer, it is believed that the best possible safeguard would be the refrigeration of the milk and its consumption within 24 hours of production. In the general trade, however, a temperature of 60° F. is believed to be safer, inasmuch as at this temperature the lactic-acid bacteria would develop at such a rate as to exclude, in a large measure, the dangerous bacteria, while the period from milking to souring would be sufficiently short to insure against too great an age of the product. Under such conditions it is also believed that the addition of formaldehyde in quantities not to exceed 1 part in 40,000 (or about 1 teaspoonful of 40 per cent formalin to 15 gal. of milk) would extend the keeping quality of the milk and improve its hygienic qualities.

The conclusions are as follows:

"(1) With different milks containing the same quantities of formaldehyde, the time of curdling varied within rather wide limits, dependent upon the character of the bacteria in the raw milk and upon slight variations of temperature.

"(2) With different milks containing different quantities of formaldehyde, the amount of formaldehyde bore no exact relation to the time of curdling.

"(3) With milk containing 1 to 2,000 up to 1 to 800 of formaldehyde there was a rapid decrease of bacteria during the first 24 hours, after which there was a slow decrease, until by the end of 5 days the milk was practically sterile, or contained only resistant spores.

"(4) With milk containing 1 to 5,000 of formaldehyde there was a rapid reduction of bacteria during the first 4 to 6 hours, but continuing throughout the entire 24, after which the bacteria continued to multiply at first very slowly, then at a very rapid rate.

"(5) With milk containing 1 to 10,000 of formaldehyde there was in some cases a slight reduction in numbers during the first 24 hours, followed by a very slow increase, then by a rapid increase. In others there was a very slow increase from the start, followed by a very rapid increase.

"(6) With milk containing 1 to 20,000 of formaldehyde there was a slow increase during the first 24 hours, followed by a rapid increase.

"(7) With milk containing 1 to 40,000 of formaldehyde the initial and later periods of increase were not differentiated, but the rise of bacteria was rapid from the start, but much less rapid than in the case of untreated milk.

"(8) Milk containing 1 to 40,000 of formaldehyde kept 2 to 3 times as long as untreated milk at the same temperature, and with 1 to 20,000 4 times as long.

"(9) When milk, containing formaldehyde, was kept at 25° C. (78° F.) there was a tendency on the part of the formaldehyde to restrain the development of the miscellaneous bacteria originally present in the raw milk, without a corresponding retardation of growth of the common lactic-acid ferment (*Bacterium acidilactici*).

"(10) *B. acidilactici* developed slowly in milk containing formaldehyde in proportions as high as 1 to 5,000, proportions sufficient to kill or entirely check the growth of other milk organisms.

"(11) Certain species of yeast were capable of growing in milk containing considerable proportions of formaldehyde, the yeast appearing first, followed by the lactic-acid fermentation.

"(12) Milk kept at 10° C. (50° F.) and containing formaldehyde in proportions as high as 1 to 10,000 remained uncurdled for a long time, but showed a large development of forms commonly found in raw milk.

"(13) The restraining action of formaldehyde was much less marked at refrigerating than at ordinary room temperatures.

"(14) With the presence of formaldehyde in milk kept at 25° C. (77° F.) the harmless lactic-acid bacteria were capable of growing better than other bacteria commonly found in milk. Hence the presence of formaldehyde, combined with normal room temperatures, is favorable to a harmless lactic-acid fermentation and unfavorable to a mixed fermentation liable to render the milk unwholesome.

"15. The presence in milk of small amounts of formaldehyde, not to exceed 1 part per 40,000, or 1 teaspoonful of 40 per cent formalin per 15 gal. of milk, and the holding of the milk at temperatures between 60 and 70° will improve its sanitary quality by preventing rapid and objectionable fermentations, and there is no reason to believe that in this proportion any marked injury could result to the person consuming it."

On abnormal butter, K. FISCHER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 6, pp. 335–339*).—Nine samples of butter made from the milk of several cows during periods when they were fed in the stable and also pastured showed Reichert-Meissl numbers varying from 15.4 to 23.6, saponification numbers from 205.5 to 215.3, iodin numbers from 39 to 47.3, Polenske numbers from 0.7 to 1.7, and molecular weights of the nonvolatile insoluble fatty acids from 267 to 272.2.

On the ripening of Edam cheese, F. W. J. BOEKHOUT and J. J. O. DE VRIES (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 10–11, pp. 321–334; abs. in Rev. Gén. Lait, 5 (1905), Nos. 1, pp. 1–9; 2, pp. 25–33; 3, pp. 59–64*).—In experiments conducted during 4 years, attempts to secure the ripening of Edam cheese with lactic-acid bacteria isolated from cheese and cultivated on whey gelatin or cheese gelatin were unsuccessful.

In proportion to the content of water the exterior layer of fresh cheese contained 13.3 per cent of salt and the central portion 0.4 per cent. With cheese 4 weeks old the salt content of the exterior and interior portions was respectively 5 and 4.4 per cent, showing a gradual penetration of the salt from the exterior to the interior. Inasmuch as the ripening of Edam cheese is uniform throughout, salt is not, therefore, believed to exert any influence on the process.

The quantity of insoluble lime is considered of great importance in the ripening process, indicating as it does the quantity of lactic acid which will be fixed and the degree of acidity of the cheese at the end of the reactions, and ruling, therefore, one of the principal factors of ripening.

The volatile fatty acids were not found to increase during ripening. There was a marked decrease in the percentage of ammonia.

The chemical difference between casein and paracasein, W. LAQUEUR (*Abs. in Österr. Chem. Ztg., 8 (1905), No. 22, p. 521*).—The paracasein was found to contain

more carbon and hydrogen but about 0.8 per cent less nitrogen than the pure casein from which it was prepared. Rennet, therefore, produces a chemical change in the casein resulting in the production of paracasein and another nitrogenous body. Paracasein has the same acidity as casein, but is more readily precipitated by salts.

The principal products and by-products of milk, G. Rovesti (*Lavorazioni moderne del latte. Prodotti principali e sottoprodotti. Casale, 1905; rev. in Rev. Gén. Lait, 5 (1905), No. 3, p. 68*).—Chapters are devoted to the composition of milk, bacteriology of milk, condensed milk, milk powders, preservation of milk, casein and its industrial utilization, milk sugar, lactic acid, alcohol from milk, acetic acid from milk, and milk soap. The treatise is recommended very highly in the review to those who are interested in the industrial utilization of milk.

A note on the bacteriological examination of milk, G. Newman (*Pub. Health [London], 18 (1905), No. 3, pp. 157-159*).—This is an outline of an address in which the author discusses the bacteriological standards for milk, the kinds of bacteria and toxins present in milk, the presence of cellular elements foreign to milk, and the degree of acidity.

The following is suggested as a bacteriological standard of purity of milk for practical purposes: (1) Total acidity of not more than 24 to 25°, (2) no excess of pus or blood cells, (3) no *Bacillus coli*, *B. enteritidis sporogenes*, or *B. enteritidis* of Gaertner in 1 cc., and (4) the milk to be nonvirulent to animals, the first and last conditions being considered fixed and absolute standards and the other two relative standards suggesting further inquiry.

Uniformity in milk culture media for bacteria, B. Czaplicki (*Milchw. Zentbl., 1 (1905), No. 10, pp. 450-456*).—Varying statements made in textbooks concerning the behavior of different organisms in milk are attributed by the author as due to differences in the milk media used.

In his experiments marked differences were obtained for the same organisms when grown in diluted milk, undiluted milk, and undiluted overheated milk. The greatest development, the most marked peptonization, and the most intensive decolorization occurred in the diluted milk. The least development took place in the overheated milk. Cholera germs from numerous sources were grown in the 3 media mentioned with marked variations in the results. The diluted milk was regularly coagulated, while in only about one-half the number of cases did coagulation occur in the undiluted milk. The differences were believed to depend principally upon the amount of sugar present.

The author recommends the dilution of the milk used for culture media in the proportion of 1:1, the media being sterilized by heating for 40 minutes at 90 to 92° C. on each of three consecutive days and kept during the intervals at 35°.

VETERINARY MEDICINE.

Economic aspect of veterinary science, S. S. Cameron (*Jour. Dept. Agr. Victoria, 3 (1905), No. 7, pp. 500-506*).—In a discussion of this problem the author draws attention to the work of eradicating animal diseases in America and England, the treatment of milk fever, abortion, and the value of a well-regulated quarantine against animal diseases.

Animal plagues and quarantine laws, Profé (*Fortschr. Vet. Hyg., 3 (1905), No. 4, pp. 73-78, fig. 1*).—The author discusses the present status of a number of animal diseases, including glanders, anthrax, blackleg, rabies, pleuro-pneumonia, and swine plague, with special reference to the effectiveness of present laws in controlling these diseases. The hope is expressed that ultimately swine plague and certain other more important animal plagues may be controlled by the proper execution of these laws.

Legislation needed for the protection of Missouri live stock, D. F. Luckey (*Ann. Rpt. Mo. Bd. Agr., 37 (1904), pp. 152-156, pl. 1*).—In the author's opinion the

live-stock laws of Missouri are not fundamentally defective, but are well suited to control the more important animal plagues if conscientiously carried out. Attention is called to the desirability of cooperation between farmers and official veterinarians in the control of animal diseases.

The importance of milk and meat inspection to the public health, T. J. SULLIVAN (*Rpt. Bur. Agr., Labor and Indus. Mont., 9 (1904), pp. 266-272*).—Attention is called to the danger inherent in pathological meat and milk as agencies in the transmission of disease. The law regarding meat and milk inspection in Montana is regarded as satisfactory and as combining all necessary features for an effective regulation of traffic in meat and milk.

Hygiene of domestic animals, N. S. MAYO (*Estac. Cent. Agron. Cuba Circ. 15, pp. 4*).—Directions are given for the disinfection of stables and careful inspection of food products, water, and salt for the purpose of preserving the health of domestic animals and preventing the introduction of diseases.

Stall disinfection by means of formaldehyde and steam produced by Lingner's apparatus, PERKUHN (*Monatsh. Prakt. Tierheilk., 16 (1905), No. 7-8, pp. 289-314, figs. 5*).—The apparatus is described in detail and a report is made on disinfection experiments carried out by the author in attempts to destroy anthrax bacilli, anthrax spores, and the bacilli of hog cholera, swine plague, swine erysipelas, and glanders.

The results obtained in these experiments indicate that formaldehyde may be used successfully in disinfecting the substances and objects which lie in the open. Bacteria which may be under straw, filth, or in cracks, however, are not much influenced, since the formaldehyde penetrates rather slowly. In order that the method may be practically efficient, therefore, it is recommended that straw and filth be carefully removed from the stalls to be disinfected and that the temperature during the process of disinfection be maintained at about 10° C.

Report of the veterinary bacteriologist, A. THEILER (*Transvaal Dept. Agr. Ann. Rpt. 1904, pp. 79-248*).—The author presents a detailed account of the distribution of rinderpest serum in various parts of Transvaal, as well as on the distribution of other serums, especially that of pleuro-pneumonia, and the effectiveness of these materials.

A careful study was made of the anatomy and life history of the blood parasite of Texas fever. When susceptible animals are inoculated with blood from an animal immune to Texas fever, parasites closely resembling those of African coast fever appear in the blood, either with the second reaction or shortly afterward. African coast fever has been definitely shown to be entirely distinct from Texas fever. Numerous experiments in the transmission of African coast fever by means of ticks have demonstrated that *Rhipicephalus appendiculatus* is chiefly concerned in this process. On account of the long period during which an infection persists in a given area it is considered impossible to eradicate the disease by means of inoculation.

Notes are also given on piroplasmosis of the horse, mule, donkey, and dog. It was found possible to immunize dogs against the disease by the use of blood from a recovered dog. The author also discusses heart water in cattle, sheep, and goats. This disease appears to be transmissible from sheep and goats to cattle, and vice versa. Observations are also made on horse sickness, together with notes on the destruction of the red blood corpuscles in this disease.

Report on work of veterinary department, S. STOCKMAN (*Transvaal Dept. Agr. Ann. Rpt. 1904, pp. 37-76, pls. 2*).—The condition of live stock sanitary laws is discussed and the policy of the veterinary department is outlined as including the purpose of compelling owners of stock to report dangerous diseases, to inspect farms, quarantine infected farms, and regulate the movement of animals during outbreaks of disease.

With regard to African coast fever it is considered as established that the disease as restricted to cattle is caused by a blood parasite, is only indirectly contagious through the agency of *Rhipicephalus appendiculatus* and perhaps *R. simus*, and that the blood parasite does not pass through the egg of the tick to the second generation. The history of the invasion and spread of the disease in the Transvaal is discussed in considerable detail, and reference is made to the various systems of dipping and vaccination which have been tested. Koch's method of inoculation has proved ineffective. The destruction of diseased animals and thorough disinfection of pastures is recommended. Notes are also given on rinderpest, glanders, tuberculosis, swine plague, anthrax, sheep scab, rabies, and meat inspection.

Conference on bovine tuberculosis, S. Arloing (*Ann. Soc. Agr. Sci. et Indus. Lyon, 8. ser., 2 (1904), pp. 139-149*).—Some of the results recently obtained in experiments on tuberculosis are outlined by the author.

Particular attention is given to experiments the results of which bear upon the question of the interrelation between bovine and human tuberculosis. The author believes that the disease is mutually transmissible between man and animals and that the time has come when an organized effort should be made by all persons concerned in the control of this plague. Enough facts are now demonstrated beyond reasonable controversy to form the basis of the crusade against tuberculosis.

Anthrax, H. A. Ballou et al. (*West Indian Bul., 6 (1905), No. 2, pp. 156-170*).—The prevalence and distribution of this disease in the West Indies is discussed for the purpose of calling attention to its origin and suitable means of controlling it. It is recommended that in the control of this disease animals should be strictly inspected before slaughter in order to prevent the distribution of infection by means of meat dealers.

Preventive inoculation for redwater, J. A. Robinson (*Agr. Jour. Cape Good Hope, 27 (1905), No. 4, pp. 505-511*).—After long experience with this disease in South Africa it is recommended that for inoculation purposes the blood of animals raised on affected premises should be used and in doses of 2 to 3 cc. For this purpose, blood should not be kept for more than 12 hours before injection. Cattle should be inoculated in early spring, when the range is in good condition, and should be carefully treated during the period of immunization.

Texas fever, W. H. Dalrymple (*Louisiana Stas. Bul. 84, 2. ser., pp. 31, figs. 2*).—The bulletin contains a general popular discussion of Texas fever, including an account of the name of the disease, cause, cattle ticks and their life history, symptoms of the disease, post-mortem appearance, curative treatment, immunization, eradication of the tick particularly by the "feed-lot" method of ridding cattle and of cleaning pastures during the summer. It is believed by the author that with united action of southern States and the Federal Government the cattle tick may be exterminated.

Anaerobic bacteria as the cause of necrosis and suppuration in cattle, L. Roux (*Centbl. Bakt. [etc.], 1. Abt., Orig., 39 (1905), No. 5, pp. 531-544*).—A microscopic study was made of 27 cases of deep necrosis and abscesses in cattle with particular reference to the bacterial content of these processes and the virulence of the organisms found in them. In nearly all cases several species were associated together.

Inoculation experiments were made in pigeons, rabbits, guinea pigs, chickens, and cattle. These inoculations were either subcutaneous or intramuscular. The bacteria found in the suppurating processes are carefully described. It appears as a result of these observations that several bacteria may be considered as causing necrosis in cattle. Among the aerobic forms coli bacillus, streptococci, and *Bacterium vulgare* are mentioned, while in the class of anaerobic organisms *Bacillus necrophorus*, *B. pyogenes bovis*, and a species of spirillum seemed to be the most important. In producing necrosis best success is had when an organism of the first group is associated with one of the second group.

Pneumo-enteritis in calves, A. W. CURLEWIS (*Jour. Dept. Agr. Victoria, 3* (*1905*), *No. 2, pp. 127–129*).—This disease most frequently attacks calves between the ages of 4 weeks and 3 months, and is very fatal, the mortality being about 95 per cent. The symptoms and post-mortem appearances are briefly described. The only effective way of controlling the disease is by means of strict isolation of all affected calves and thorough disinfection.

The influence of cold on the virus of foot-and-mouth disease, E. PERRONCITO (*Fortschr. Vet. Hyg., 3* (*1905*), *No. 4, pp. 78, 79*).—The opportunity was offered of studying the effect of cold upon the virus of foot-and-mouth disease.

A sample of the virus in the saliva of diseased cattle was kept over night at a temperature of −8 to −9° C. In the morning the virus was found frozen and after being thawed out was used for inoculating two healthy calves and two sheep. None of these animals became infected, and it appears, therefore, that the subjection to −8 to −9° C. is sufficient to destroy the virulence of the virus. The author hints at the economic importance of this fact.

Spraying v. dipping, A. W. DOUGLASS and L. J. ROBERTS (*Agr. Jour. Cape Good Hope, 27* (*1905*), *Nos. 1, pp. 108–112; 2, pp. 247–249*).—This is a controversial discussion of the comparative value and effectiveness of spraying and dipping.

The first-named author argues in favor of spraying cattle with kerosene as being a method more effective and less harmful than dipping, particularly if arsenic be added to the dips. Kerosene mixed with water mechanically is claimed to be quite harmless to the skin of cattle and costs about 4 cents per head. The actual cost of dipping is not much more, but the original cost of the dipping plant is much greater than that of the necessary spraying apparatus.

Mr. Roberts maintains, on the contrary, that dipping is much more satisfactory than spraying, and has displaced the latter method on nearly all cattle ranches. It is argued that 1,000 cattle can be dipped in the time required to spray 200 head. Dipping is also claimed to be a much more effective method of destroying the ticks than spraying.

Sheep dipping (*Bd. Agr. and Fisheries* [*London*], *Leaflet 145, pp. 4*).—Notes are given on methods and materials to be used in dipping sheep for *Melophagus ovinus, Ixodes reduvius,* and *Lucilia sericata.* For this purpose a hand bath, swimming bath, or cage bath may be used.

Various preparations were used as dips, including combinations of arsenic and soda, sodium compounds of sulphur, lime and sulphur, carbolic acid, tobacco extracts, and soaps. Crude tar and tar acids appear to destroy the pests most quickly, while tobacco dips were nearly as active.

Vaccination for sheep pox and blackleg with products prepared in the Pasteur Institute of Algeria, SOULIÉ (*Bul. Agr. Algérie et Tunisie, 11* (*1905*), *No. 15, pp. 339–341*).—During the 5 years from 1900 to 1904, inclusive, 4,732,960 sheep were vaccinated against sheep pox. The mortality among this number was 1,800. In vaccination for blackleg 138,068 cattle have been treated since 1897. The total loss among this number was 150.

The indefinite preservation of the virus of sheep pox in leeches, F. J. and E. BOSC (*Compt. Rend. Soc. Biol.* [*Paris*], *58* (*1905*), *No. 7, pp. 299–301*).—Considerable difficulty has been experienced in preserving the virus of sheep pox without its undergoing rapid changes. A mixture of lymph or infected tissue in pure glycerin or diluted in water becomes rapidly attenuated.

It was found, however, that when leeches were allowed to attach themselves in the region of the pustules of sheep pox, the blood and virus thus obtained retained its virulence for long periods, even 2 years, without any noticeable attenuation. It appears that in such cases the virus may be partly digested and absorbed into the body cavity of the leeches without undergoing serious changes. It is believed that

the process may be applicable to the preservation of smallpox vaccine and vaccine for foot-and-mouth disease.

Prevention and cure of foot rot in sheep (*Jour. Bd. Agr. [London], 12 (1905), No. 6, pp. 360–364*).—In treating this disease it was recommended that copper sulphate be used at the rate of 1 lb. to a gallon of water, or a weaker solution if prevention is the only aim of the treatment. It is considered preferable to buy copper sulphate in the powdered form and under a guaranty of 98 per cent purity. Badly affected sheep should have their hoofs pared before they are driven through the copper sulphate bath.

Simple rules for judging reactions of tuberculin and mallein, O. MALM (*Norsk Vet. Tidsskr., 17 (1905), Nos. 3, pp. 49–58; 4, pp. 53–82; 5, pp. 97–100*).—The various factors which may influence tuberculin and mallein reactions are critically discussed by the author. The nature of tuberculin is defined and notes are given on the strength and specific qualities of this reagent.

In determining reactions many points have to be considered. The author believes that Koch's tuberculin is the best for use in determining the existence of tuberculosis. The most active agent in the tuberculin is a toxin of a specific nature. The conclusions are reached that cattle must be considered tuberculous if they show a temperature not above 39.5° C. before injection, and a rise of at least 1° C. after injection above the highest temperature shown before the tuberculin was administered. With calves under 6 months of age, showing a range of temperature from 39 to 39.5° C., it is considered as a sufficient ground of suspecting tuberculosis if the temperature rises above 40° C. after injection. It is recommended that tuberculin tests be not given to cattle which show a temperature above 39.5° C.

With regard to the use of mallein in the detection of glanders, it is recommended that this product be under State control and that, for injection, 0.5 cc. of the fluid preparation be used or 7 cg. of the dry material. All horses which show a rise of temperature to the extent of 1 to 2° C. within 24 hours after injection, together with general or local symptoms of irritation, are to be considered as certainly glanderous.

Report upon experiments made in the Royal Veterinary College, Dublin, on two horses obtained from a stud infected with glanders, A. E. METTAM (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1905), No. 1, pp. 39–44*).—The two animals discussed in this article came from a stable where glanders had prevailed, and were kept under observation for the purpose of determining whether they had glanders, and also whether mallein would have a curative effect upon the disease or develop a tolerance in animals repeatedly inoculated with it.

During the course of the experiments each animal received 5 injections of mallein, the first 4 being administered at intervals of 1 week, after which 3 months were allowed to elapse before the last injection was made. Both of the animals were killed and carefully examined post-mortem. One animal was undoubtedly glanderous and responded promptly with the usual reactions after each injection. The other animal did not respond at any time, and upon the post-mortem was found to be free from glanderous lesions. A test was made on a third horse to determine the effect of killed cultures of glanders bacilli. An injection of 5 cc. of an emulsion of glanders bacilli produced no bad effects in the horse.

The author believes that the results obtained during these experiments indicate that mallein is a trustworthy diagnostic agent for glanders; that no tolerance to mallein is set up in an animal which receives repeated doses of mallein, and that infection with glanders probably occurs chiefly through the alimentary tract. The last conclusion is based on the fact that one horse did not acquire glanders, although constantly associated with the other glanderous horses.

Glanders of horses, R. R. DINWIDDIE (*Arkansas Sta. Bul. 87, pp. 61–76*).—A portion of this bulletin is occupied with a brief discussion of the nature, symptoms,

diagnosis, treatment, and prevention of glanders, with notes on the use of mallein and on officirl inspection for glanderous horses.

The Arkansas law relating to this matter provides for notification of horses affected with the disease, isolation of such animals, the prevention of traffic in affected horses or mules, the use of mallein test, and thorough disinfection of the premises after an outbreak of glanders. Brief notes are also given on the present prevalence of glanders in Arkansas. Details of inspection work carried out under this law in 1904 are furnished by J. F. Stanford.

A case of uveitis malleotica, J. DE HAAN (*Fortschr. Vet. Hyg., 3 (1905), No. 3, pp. 49, 50*).—The literature relating to the occurrence of glanders in the eyes of horses is briefly discussed in connection with a description of the symptoms as observed by the author. An examination of a case which came under observation disclosed the fact that the glanders bacilli were present in pure cultures in the exudate from the iris and choroid coat.

The action of certain oxidizing substances upon the toxin of tetanus, C. PADERI (*Arch. Farmacol. Sper. e Sci. Aff., 4 (1905), No. 1, pp. 3-23*).—The author studied the effect upon tetanus toxin of certain oxidizing substances including ozone, permanganate of potash, and sulphate of soda.

It was found that ozone, on account of its oxidizing property, greatly irritated the tissues with which it came in contact and was, therefore, somewhat injurious to the organism. It also destroyed the tetanus toxin wherever it came in contact with it. Ozone, however, apparently had no effect upon the tetanus toxin circulating in the blood, since it could not be brought in contact with it. Similarly, permanganate of potash, when brought in contact with tetanus toxin outside of the organism, quickly destroyed it, but had no effect upon the toxin circulating in the living animal organism. Sulphate of soda was even less effective.

It appears that the three oxidizing substances studied by the author are not capable of increasing the oxidizing power of the animal organism toward toxic substances in circulation in the tissues.

Studies and observations on rabies, E. BARTERELLI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 39 (1905), No. 4, pp. 399-409*).—It was found during the author's study that the salivary glands of rabbits affected with rabies may sometimes become infectious, particularly if an unusually virulent virus is used.

The author studied also the relation between the appearance of Negri's corpuscles and the use of fixed virus. Experiments in the transmission of rabies to cold-blooded animals showed that the virus has no effect upon them, being excreted rapidly after injection. A study of the saliva of a man affected with rabies showed that this material was exceedingly virulent.

Rabies in Muridæ, C. FRANCA (*Compt. Rend. Soc. Biol.* [*Paris*], *58 (1905), No. 9, pp. 410, 411*).—It was found possible to produce rabies in various species of Mus and Arvicola by inoculation.

The form of the disease was usually paralytic, the symptoms being quite pronounced in all cases. A histological examination disclosed the presence of diffuse infiltration of leucocytes in the medulla oblongata and nerve ganglia, but none of the nodules described by Van Gehuchten. By means of the silver method recommended by Ramon-y-Cajal lesions are demonstrable in the nerve fibrillæ.

Treatment of rabies with radium, G. TIZZONI and A. BONGIOVANNI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 39 (1905), No. 4, pp. 473-477*).—A number of laboratory animals were inoculated with fixed virus and subsequently treated with radium rays. At the time of the report it was 2 months since inoculation and the animals were considered as cured.

The curative action of radium was tested quite extensively. It was found that 10,000 radio-active units applied directly upon the eye of inoculated rabbits had the same effect whether the application was continued for 8 hours or whether 8

applications were made of one hour each. It was found also during these studies that fixed virus in vitro is rapidly decomposed by radium rays and modified into very effective vaccine toward rabies.

Fowl plague in geese, F. K. KLEINE and B. MÖLLERS (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig.*, *39* (*1905*), *No. 5*, *pp. 545-549*).—It has already been shown that the filterable virus of fowl plague may make its way into the spinal cord and brain of geese. Old geese are not very susceptible to the disease, while geese one year old or younger readily succumb within 7 days after the infection. Attention has already been called to the fact that the virus is often absent from the blood of geese dead of the disease. It is always present, however, in the brain and spinal cord, and these materials may be used for inoculation.

A number of inoculation experiments were made with such material. The presence of the organism of the disease in the blood appears to cause no great elevation of temperature until shortly before death. In some cases a subnormal temperature was noted. It appears to be possible to cultivate the virus of fowl plague until it becomes so virulent for young geese that it will not disappear from the blood. No success was had in transferring the disease to pigeons and ducks. Apparently the organism of fowl plague soon dies in unsusceptible animals. In the author's experiments it was found that the disease could be transmitted readily by placing the virus in the conjunctival sac.

Trichina and trichinosis, N. I. PETROPAVLOVSKI (*Arch. Vet. Nauk* [*St. Petersb.*], *35* (*1905*), *Nos. 8*, *pp. 714-743*; *9*, *pp. 841-879*, *figs. 7*).—The present article is in the nature of a monograph on the life history and developmental possibilities of the trichina.

In the course of the author's investigations, feeding experiments were carried on with the lard of infested swine, with infested muscles, and other tissues. A study was also made of the resisting power of trichina to the usual salting process applied to meat. Numerous experiences were also carried on in subjecting trichina to various chemical agents, such as turpentine, alcohol, chloroform, and other substances. A study was made of the reaction of trichina toward glycerin, tartaric acid, hydrochloric acid, boric acid, carbolic acid, salt, salicylates, and other substances.

Parasites in cattle and poultry in Trinidad, C. W. MEADEN (*Trinidad Bot. Dept., Bul. Misc. Inform.*, *1905*, *No. 47*, *pp. 203-208*, *fig. 1*).—Notes are given on a number of parasitic worms in cattle and chickens, especial attention being given to *Strongylus filaria*.

Nodular disease of the intestines of cattle and sheep, L. SCHEBEN (*Fortschr. Vet. Hyg.*, *3* (*1905*), *Nos. 5*, *pp. 97-104*; *6*, *pp. 121-125*, *figs. 13*).—The anatomy of *Ankylostomum radiatum* is described in detail and notes are given on the lesions which this worm produces in the intestines of cattle and sheep.

The question of the correct scientific name of this species is discussed at some length. It is argued that Ankylostomum is the common form found in intestinal nodules of cattle and sheep in Europe as well as America and that the genus Œsophagostomum is of much rarer occurrence in such lesions.

Veterinary department, E. L. MOORE (*South Dakota Sta. Rpt. 1905*, *pp. 30-32*).—In examining sheep affected with parasites, every autopsy revealed the presence of *Moniezia expansa* in the intestines and hepatic ducts.

The entire flock was treated with a solution of copper sulphate with good results. A test was made of Zenoleum in various strengths, Skabcura, and Pino Lyptol in destroying sheep ticks. Zenoleum in solutions of 1 to 2 per cent gave good results. The other remedies were effective when used in solutions of 25 per cent for Skabcura and 1 per cent for Pino Lyptol. Brief notes are also given on azoturia and glanders.

Stomach worms, A. A. BROWN (*Jour. Dept. Agr. Victoria*, *3* (*1905*), *Nos. 2*, *pp. 143-146*; *4*, *pp. 340*, *341*, *pls. 4*).—The author discusses the appearance, injurious effects, and remedies for stomach worms in the horse and sheep.

The treatment for stomach worms of the horse must be preventive, since no drug can be successfully used in expelling the parasites from the stomach. Particular attention is given to a discussion of *Spiroptera megastoma*. *Strongylus contortus* in sheep produces poorly defined symptoms. In preventing infestation with this worm sheep should be kept away from marshy pastures. Infested sheep may be treated with bisulphid of carbon in doses of 20 to 30 drops or with a mixture of ether and turpentine.

RURAL ENGINEERING.

The work of the Office of Experiment Stations in irrigation and drainage (*U. S. Dept. Agr., Office Expt. Stas. Circ. 63, pp. 30*).—This circular contains statements of A. C. True and Elwood Mead before the Committee on Irrigation of Arid Lands of the House of Representatives, regarding the work of the irrigation and drainage investigations in general, and details of the lines conducted in 1904.

Doctor Mead gives a more detailed statement of the work done during the season of 1904.

Irrigation in the western United States, R. A. VAN SANDICK (*Separate from Compt. Rend. Inst. Colon. Internat., 1905, pp. 119, figs. 28*).—This is a discussion of all phases of irrigation in the United States.

The article opens with a theoretical discussion of the economic and legal questions arising in the development of a newly occupied arid region. Then follow a description and statistical account of the arid and semiarid portions of the United States, a history of the gradual development of irrigation, a description of different kinds of irrigation constructions with the defects that have been developed in use, a classification of the different methods of obtaining water for irrigation, a description of reservoirs, earth and masonry dams, irrigation statistics, an account of the National Reclamation Act and the work which has been projected thereunder, and a consideration of the relations between State and National legislation upon irrigation.

The paper is followed by a lengthy discussion by members of the International Colonial Institute.

The East Canyon Creek Reservoir, Morgan County, Utah, W. M. BOSTAPH (*Engin. Record, 52 (1905), No. 22, pp. 594–596, pls. 3, figs. 2*).—This is a detailed description of a dam which has been described before in Government publications and periodicals.

It is a rock-filled dam with steel core protected by asphaltum concrete. Methods and cost of construction are given. The cost of dam and outlet tunnel was $127,361, or $9.93 per acre-foot of available capacity. "From a financial point of view, the enterprise has been more successful than the most sanguine of its friends anticipated. A careful estimate of crops produced by reservoir water in the year 1904 shows their value to be over $75,000, more than 58 per cent of the cost of the entire work."

Irrigation furrow plow (*Maschinen Ztg., 3 (1905), No. 21, p. 253, figs. 2*).—The plow consists of a double moldboard lister plow mounted on a four-wheeled frame. Directly behind the plow is attached an oval-shaped roller which presses the dirt into an oval-shaped ditch in the furrow made by the plow. This roller is provided with scrapers to prevent clogging. Attached to the moldboards are two blades extending backward at angles of about 45 degrees. The dirt thrown up by the plow is spread out to both sides of the ditch by means of these blades which smooth the surface next to the ditch. At the outer end of the blades are attached a few harrow teeth which spread whatever dirt reaches this point.

Underground waters of Salt River Valley, Arizona, W. T. LEE (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 136, pp. 196, pls. 23, figs. 25*).—About half of this paper consists of a careful compilation of all the information that could be obtained about every well in the valley, including the size, depth and yield, and the

formations passed through by each well. Then follow in order a discussion of the geology and physiography of the valley, of the area in which pumping underground water for use in irrigation is profitable, and of the origin of the salts in well waters and their effects on vegetation. The quantity of underground water is estimated in various ways, and the cost of pumping is discussed.

The valley fill, at least to a depth of several hundred feet, consists of river débris, wash from near-by hillsides, and chemical precipitates in more or less impervious layers, which serve in many cases to confine the underground water under some pressure. The valley fill is saturated with water more or less impregnated with various salts derived from Salt River.

The quantitative estimate of the underflow indicates a volume of flow of 148,196 to 287,760 acre-feet per year. At this rate something less than 96 pumping plants, each supplying 200 miner's in. or 5 cu. ft. per second, could be operated continuously.

"The cost of pumping in Salt River Valley varies from 5.4 to 13.8 cts. per acre-foot per foot of lift, or a cost per acre-foot of pumped water of \$2.50 to something like \$5. The volume of underflow is large, but not inexhaustible by the operation of pumps. It is capable of extended development, but there is danger that a greater draft will be made upon it than is consistent with the maintenance of the water level within practicable pumping distance."

A report on the establishment of tide-gauge work in Louisiana, G. D. HARRIS (*Geol. Survey La. Bul. 3, pp. 28, pls. 8, figs. 5*).—This is an account of the establishment of a tide-gauge station near the Gulf Coast for the purpose of determining mean tides, as the basis for establishing reliable bench-marks through southern Louisiana. The data secured will be of special value in the drainage of marsh lands along the Gulf, as it will show not only the mean-tide levels, but the height of extreme tidal waves from which the lands must be protected if they are to be used for agriculture.

It is the intention to determine by a long series of tide-gauge readings the elevation of a few seacoast bench-marks with great accuracy, and from them run a line of precise levels along the Southern Pacific Railroad and establish at intervals of, say every 5 miles, permanent bench-marks, and thereby give the true height of the same above sea level. All local lines can then be referred to one datum plane. Fairly reliable bench-marks many miles from the railroad will very soon be left by local engineers and the mapping of the region will be greatly facilitated. The results secured will be of scientific value also in the study of laws of tidal action. A detailed description of the station established at Weeks Island is given.

A study of rock decomposition under the action of water, A. S. CUSHMAN (*U. S. Dept. Agr., Office Public Roads Circ. 38, pp. 10, figs. 3*).—This is a discussion of laboratory methods of testing the decomposition of rock under the action of water, describing a new method now being used.

Manual for Iowa highway officers, A. MARSTON, C. F. CURTISS, and T. H. MACDONALD (*Ames: Iowa Highway Com., 1905, pp. 102, pls. 20, figs. 8*).—The legislature of Iowa on April 13, 1904, created the State highway commission, whose duties are to devise plans for improvement in the highways of the State, to disseminate information on the subject of good roads, and conduct demonstrations in road construction.

It is provided that the State College of Agriculture and Mechanic Arts shall act as a highway commission, and the board of trustees of the college has intrusted this work to the engineering and agricultural departments. The manual is issued by this commission. It contains a general discussion of the value of good roads, and the topography of the State with reference to road materials and construction. The State of Iowa has at present about 100,000 miles of public roads, not over 1,000 miles of which have been surfaced with either gravel or stone. Most of the roads of the State are made on section lines, but the commission recommends the abandon-

ment of this system and the locations of roads in such a way as to avoid the hills and thus reduce grades.

The necessity of drainage in order to secure a solid roadbed and to remove water from the surface of the roads is brought out, and it is recommended that road officials cooperate with drainage officials in providing for drainage. Tables are given showing the areas which can be drained with different sizes of tiles and open ditches. Specifications for drains and prices for grading are given, and various machines for road construction and maintenance are described. The King road drag, which consists of split logs or planks fastened together, is especially recommended for maintaining the surface of roads in proper condition.

Directions for the construction and maintenance of dirt, gravel, and macadam roads, and specifications for the construction of reinforced concrete culverts are given. The results of traction tests on earth and gravel roads and comparative traction tests with wide and narrow-tired wagons are included.

Road improvement in South Carolina, P. T. Brodie (*Clemson Agr. Col. Ext. Work, 1 (1905), No. 1, pp. 18–44, pls. 11*).—This is a general discussion of the subject of good roads, with some reference to South Carolina conditions.

The average cost of wagon hauling on the roads in the United States is estimated at 25 cts. per ton mile, while the cost of hauling on good roads is estimated at 10 cts. per ton mile. For improving South Carolina conditions it is recommended that grades be reduced both by cutting and filling and by going around hills rather than over them where this is necessary; and by surfacing roads with a mixture of clay and sand. A general discussion of construction of stone roads is also included.

Petrol, paraffin, or alcohol for agricultural motors, D. Albone (*Mark Lane Express, 93 (1905), No. 3868, Farm Mach. and Impl., p. III*).—This gives the results of experiments with an agricultural motor, using petrol, paraffin, and alcohol. A single motor has been made which will use any one of these. The comparative results were as follows: "With 2 gal. of petrol 3 roods of land were plowed; with 2 gal. of paraffin 2 roods, 35 poles were plowed; with 2 gal. of alcohol 2 roods, 25 poles were plowed."

Modern refrigerating machinery; its construction, methods of working, and industrial applications, H. Lorenz, trans. by T. H. Pope (*New York: J. Wiley & Sons; London: Chapman & Hall, Ltd., 1905, pp. X + 396, figs. 271*).—This is intended as a guide for engineers and owners of refrigerating plants, and contains chapters on the principles of the theory of heat, methods of cold production and energy required, the construction of compressors, apparatus for giving out and taking up heat, the erection of absorption machines, the cooling of liquids and keeping them cold, cooling air, manufacture of ice, production and application of cold at very low temperatures, and determination of the yield of cooling machines. There are chapters on American practice in refrigeration, insulation, and auditorium and other cooling, by H. M. Haven and F. W. Dean.

RURAL ECONOMICS.

Contributions to the economics of agriculture, F. Aereboe (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 3, pp. IV+311–457*).—This monograph treats of the general principles which underlie the organization of the farm in such a manner as will enable the farmer to secure, one year with another, the best possible results.

The factors of production—land, labor, and capital—are discussed from the standpoint of the proper degree of intensity of culture. The various branches of agricultural production, such as grain production, fodder production, and the various lines of live-stock production, are discussed from the standpoints of their relations to each other and of the external conditions, such as the character of the soil and the local market prices of the products, which determine the relative importance to be given to each of these lines of production.

Agricultural explorations in Algeria, T. H. KEARNEY and T. H. MEANS (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 80, pp. 98, pls. 4*).—This bulletin describes the climate, topography, soil, agricultural products, and general economic conditions of Algeria.

The climate of Algeria is comparable to that of California. The vine is the greatest single source of wealth. The average annual value of the products of the vineyards is estimated at $5,000,000. The principal orchard fruits are the olive, citrus fruits, figs, and dates. Of these, the olive stands first in commercial importance. Near the coast are many market gardens, from which shipments are made to the European markets in the winter and early spring.

The principal field crops are wheat and barley, which occupy about 7,000,000 acres annually, and which supply a large export trade. Indian corn and sorghum are grown by the natives. "The only valuable 'industrial' crops are tobacco and certain plants used in the manufacture of perfumery."

Studies upon the development of the demand for agricultural labor in East Prussia during the nineteenth century, F. WEGENER (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 311-488*).—This paper shows that there was a great increase in the production of all classes of farm products in East Prussia during the nineteenth century.

It is emphasized that this increased production has resulted principally from an increase in the intensity of culture. The higher degree of intensity of culture has necessarily made an increased demand for labor. The increase in the number of laborers has not kept pace. There have been two results: (1) Wages have risen and the condition of the agricultural laborers has been materially improved. (2) Labor-saving machinery has been introduced.

"The introduction of machinery in agriculture has not, as in the manufacturing industries, resulted in the lowering of the level of intelligence among the working classes. On the contrary, it has resulted in increased intelligence and skill. . . . Machinery has not resulted, as in the manufacturing industries, in a decrease but in an increase in wages."

Agricultural laborers in the district of Melun, H. HITIER (*Jour. Agr. Prat., n. ser., 10 (1905), No. 41, pp. 458, 459*).—This article is a brief review of a comprehensive report on the same subject by M. Brandin.

In recent years the native agricultural laborers of northern France, notably in the regions of sugar-beet production, have desired the restriction and even the prohibition of the immigration of foreign agricultural laborers. The native laborers believe that such restriction will result in an important increase in their wages. The investigations of M. Brandin lead to the conclusion, however, that such restrictions will depress rather than raise wages.

There are two systems of crop rotation from which the farmer of this district may choose: First, wheat, oats, and sugar beets; and, second, wheat, oats, and grass crops sown with the oats. It is calculated that the first system makes a demand for five laborers on the same area that the second system makes a demand for two; but if the native laborers must be depended upon, there will be no more than three laborers where five will be needed for the system including the sugar beets. Hence the restrictions on the influx of foreign laborers will make it necessary for the farmers to resort to the more extensive of these two systems of culture. This will make a demand for but two laborers where there are three native laborers competing for the positions.

Thus it is that restrictions on the immigration of laborers instead of resulting in a rise in wages may bring about a retrograde movement in agriculture and depress wages.

Laborers' holdings in Denmark (*Dept. Agr. and Tech. Instr. Ireland Jour., 5 (1905), No. 4, pp. 701-709*).—This article describes recent legislation in Denmark which provides for State aid to agricultural laborers in securing small holdings.

Agriculturists and breeders, L. LÉOUZON (*Agronomes et Eleveurs. Paris: J. B. Baillière & Sons, 1905, pp. 360, pls. 20*).—This book contains a sketch of the lives and the contributions to scientific agriculture of twenty-two eminent agriculturists, namely: Robert Bakewell, founder of the breeder's art; Charles and Robert Colling, of the County of Durham, Eng., who developed the breed of Durham cattle; Arthur Young, an agricultural writer and first secretary of the English Board of Agriculture; Sir John Sinclair, first president of the English Board of Agriculture; Coke, of Holkham, a champion of large farms, intensive culture, and scientific methods in English agriculture; Jonas Webb, the improver of the Southdown breed of sheep; Sir John Bennett Lawes, founder of the Rothamsted Experiment Station; Albrecht Thaer, agriculturist, breeder, author, and educator; Oliver de Serres, a French agricultural writer; Tessier, who introduced merino sheep into France; Mathieu de Dombasle, founder of the School of Agriculture at Roville; Auguste Bella, agricultural writer and educator; C. A. Yvart, Belgian veterinarian and breeder; A. E. Pierre, Comte de Gasparin, noted for his work on contagious diseases of animals; Emile Baudement, a writer and educator on the subject of cattle breeding; Edward Malingié, sheep breeder, writer, and educator; J. B. Boussingault, agricultural chemist and physicist; J. A. Barral, agricultural journalist; and Edouard Lecouteux, agricultural writer and educator.

Trade with noncontiguous possessions in farm and forest products, 1902–1904 (*U. S. Dept. Agr., Bur. Statis. Bul. 37, pp. 49*).—This report contains statistics of the trade in farm and forest products between the United States and her noncontiguous possessions, viz, Porto Rico, Hawaii, Alaska, Philippine Islands, Tutuila, Guam, and Midway Islands.

Farm products represent 36.2 per cent of the value of the shipments from the United States to the noncontiguous possessions, and 79.6 per cent of the shipments to the United States from these possessions. "In 1904 sugar formed 75 per cent of the total shipments of domestic merchandise from Porto Rico to the United States and 97 per cent of the corresponding shipments from Hawaii. Manila formed 92 per cent of all domestic merchandise imported from the Philippines into the United States in 1904."

Imports of farm and forest products, 1902–1904 (*U. S. Dept. Agr., Bur. Statis. Bul. 35, pp. 82*).—This bulletin presents a statistical review of the sources, the character, and the value of imports of farm and forest products into the United States.

The imports of farm products in 1904 were valued at $461,434,851, and represented 46.6 per cent of the total imports. The imports of forest products in the same year were valued at $79,619,296. Over 62 per cent of the imports of farm products came from eight countries, viz, Cuba, Brazil, United Kingdom, Japan, China, Mexico, Italy, and France. Sugar is the principal farm product imported from Cuba, coffee from Brazil, wool from the United Kingdom, and raw silk from Japan.

The leading imports of farm and forest products in the order of their importance in 1904 are: Sugar, $72,933,951; coffee, $69,551,799; hides and skins other than furs, $52,006,070; vegetable fiber, $46,355,795; silk, $46,100,500; India rubber, $40,444,250; wool, $24,813,591; fruits, $18,964,688; tea, $18,229,310; tobacco, $16,939,487; lumber, $12,026,857.

Exports of farm and forest products, 1902–1904 (*U. S. Dept. Agr., Bur. Statis. Bul. 36, pp. 108*).—This report shows the quantities and the values of the imports and the exports of the various classes of farm and forest products to and from the Undite States.

The value of farm products exported during the year ended June 30, 1904, was $872,000,000, which is greater than for any previous year, with the exception of the 2 years 1901 and 1903. But while the value of exports of farm products has greatly increased during the past 15 years, this increase has not kept pace with that of other lines of production. Farm products represented only about 60 per cent of

the total value of our domestic exports in 1904, whereas the percentage was about 68 on the average during the 15 years from 1890 to 1904.

The figures show that while the exports of other kinds of farm products remained stationary or increased, the exports of grain and grain products decreased from $221,-459,086 in 1903 to $149,366,054 in 1904, which is less than in any other year since 1891. The exports of forest products more than doubled during the decade ending June 30, 1903. The exports for 1904 were valued at $70,000,000, which was an increase of about $12,000,000 over any previous year.

The United Kingdom, by far the most important purchaser of our farm and forest products, takes about 47 per cent of the farm products and about 30 per cent of the forest products.

Crop export movement and port facilities on the Atlantic and Gulf Coasts, F. ANDREWS (*U. S. Dept. Agr., Bur. Statis. Bul. 38, pp. 80*).—This report is a study of the commercial movement of cotton, corn, and wheat in the United States.

A discussion is given of the regions where these materials of commerce are produced in the United States, of the primary markets or trade centers in the interior where they are concentrated, of the movements from the primary markets to the various Atlantic and Gulf ports, and of the facilities for handling these products at these ports. It is shown that the proportion of the export of cotton and wheat exported from the Gulf ports has gradually increased during the last twenty years, whereas the proportion exported from the Atlantic ports has declined.

From 1884–1888, 44 per cent of the cotton exported was shipped from the Gulf ports and 55 per cent from the Atlantic ports. During the same time 2 per cent of the wheat exported was shipped from the Gulf ports and 59 per cent from the Atlantic ports. In 1904, 65 per cent of the cotton and 55 per cent of the wheat exported were shipped from the Gulf ports and only 33 per cent of the cotton and 20 per cent of the wheat exported were shipped from the Atlantic ports.

Agricultural statistics of Ireland for 1904 (*Dept. Agr. and Tech. Instr. Ireland, Agr. Statis. 1905, pp. XXXVIII + 165, dgms. 2*).—This report contains statistics on the size of farms, the areas devoted to the different lines of production, the number of live stock on farms, and the number of live stock exported.

The statistics show Ireland to be primarily a grazing country. About 75 per cent of the total area, or about 15,000,000 acres, is devoted to agricultural purposes. Of this only 15.6 per cent is devoted to crops other than hay, 14.9 per cent to hay, and 69.5 per cent to pasture. The acreage devoted to crops has been steadily decreasing for many years, while the areas devoted to hay and pasture have been increasing. The oat crop is by far the most important of the grains grown in Ireland, and cattle are the most important live stock. Cattle, horses, sheep, and swine are exported to Great Britain in relatively large numbers.

While there are a few large farms in Ireland, the agricultural holdings are, as a rule, small. The average size of holdings larger than one acre is about 29 acres, which is less than half the size of those of England.

Report of the government statistician on agricultural and pastoral statistics for 1904 (*Rpt. Govt. Statis. on Agr. and Pastoral Statis. Queensland, 1904, pp. 57*).—This report contains statistics on the sizes of farms, flocks, and herds; on irrigation; on the production of meat, dairy products, poultry, honey, wool, cotton, cereals, coffee, fruits, sugar, tobacco, and wine; and on the agricultural exports and imports of Queensland.

AGRICULTURAL EDUCATION.

First principles of agriculture for the primary schools of Bolivia (*Primeras nociones de agricultura para les escuelas primarias de Bolivia. La Paz: Min. Colonies and Agr., 1905, pp. 52*).—This is an elementary text-book of agriculture issued by the Ministry of Colonies and Agriculture for the primary schools of Bolivia.

It contains chapters on the nature of soils, preparation of soils, tillage experiments, influence of climate, irrigation and fertilizers, seed time and harvest, cereals, legumes, root crops, forage plants, textile plants, sugar plants, dye plants, oil-producing and aromatic plants, arboriculture, zootechny and breeding, and agricultural machinery. The last two subjects are treated with great brevity, occupying only 2½ pages of the pamphlet.

Horticultural education, F. A. WAUGH (*Trans. Peninsula Hort. Soc.* [*Del.*], *18* (*1905*), *pp. 123–130*).—A paper showing recent progress in methods of horticultural instruction and bringing out the educational factor in horticulture.

Agriculture in the schools, F. H. HALL (*School News and Pract. Ed.*, *19* (*1905*), *No. 3, pp. 118, 119*).—A discussion of some of the things Illinois has done to promote the teaching of agriculture in the public schools.

Nature study, F. OVERTON and MARY E. HILL (*New York, Cincinnati, and Chicago: American Book Co., 1905, pp. 142, figs. 66*).—The design of this book is to furnish a year's work in nature study for pupils from 8 to 11 years of age upon subjects connected with everyday life and easily procured, even in the larger cities.

The subjects are arranged in the order of the seasons, and the lessons are intended to throw light on the unfamiliar side of familiar things as a basis for future scientific studies. Under each subject the work of one lesson is outlined quite fully, then suggestions are given for supplementary work intended to cover several lessons. The book thus embodies two valuable features, (1) concrete and detailed directions for a certain amount of work in connection with each subject considered, and (2) questions and suggestions which are presented in such a way as to stimulate continued observation and study on the part of both teacher and pupil.

Mrs. Anna B. Comstock, of the Bureau of Nature Study, Cornell University, has written an introduction to the work.

Nature teaching, F. WATTS and W. G. FREEMAN (*New York: E. P. Dutton & Co., 1904, pp. 193, figs. 20*).—This is a revision of an earlier work, prepared by Francis Watts for use in the West Indies, to adapt it to conditions existing in the British Islands.

The book is intended for use in schools and is quite strongly agricultural in its bearing, as the following list of chapter subjects indicates: The seed, the root, the stem, the leaf, the soil, plant food and manures, flowers and fruits, weeds, and animal pests of plants. Numerous experiments which will demand some originality on the part of both teacher and pupil are suggested. A glossary is given and appendixes which contain suggestions for courses of study and a list of apparatus and materials required for the work outlined in the book.

Nature study, W. N. HUTT (*Md. Agr. Col. Bul.*, *1* (*1905*), *No. 3, pp. 20, figs. 10*).—Nature study is defined and its purposes in the school are discussed. The writer also tells how to teach nature study, how to prepare material, and gives suggestions for nature study work at different seasons of the year.

A nature study of Maryland plants, F. H. BLODGETT (*Md. Agr. Col. Bul.*, *2* (*1905*), *No. 1, pp. 26, pls. 14*).—Numerous common plants of Maryland are taken up in the order of blossoming and their habitat and some peculiarities are described. The bulletin is adapted to the use of the teacher and the numerous questions interspersed through the text are intended to aid in an intelligent study of the incidents in the lives of plants.

Report of the committee on school gardens and native plants for the year 1904, H. S. ADAMS (*Trans. Mass. Hort. Soc., 1905, II, pp. 295–317, pls. 7*).—This report includes an account of school gardens, children's home gardens, children's herbariums, and collections of native plants, all of which are encouraged by the Massachusetts Horticultural Society by means of prizes and gratuities, amounting in 1904 to $225. Detailed reports are given of school gardens in Framingham, Groton, and Lynn, Mass.

School gardens for California schools, B. M. DAVIS (*Cal. State Normal School, Chico, Bul. 1, pp. 79, figs. 11, chart 1*).—This is a manual for teachers based on experiments in school garden work at the Los Angeles and Chico State normal schools.

The author deals briefly with the history and development of school gardens and their educational value; devotes a chapter to the plant and its relations, including soils, fertilizers, temperature, and plant enemies, with an annotated list of some of the most common and important insects of California; another chapter to plant propagation, in which is included a plant calendar containing condensed information concerning quite a variety of vegetables, flowers, and climbing plants; a third chapter to instruction, including practical work and correlative subjects; a brief description of school gardens at Los Angeles and Chico; an abridged list of useful books and bulletins for a school library; references to literature on insects mentioned in the text, and a bibliography of 218 entries on school gardens, nature study, elementary agriculture, and horticulture. An appendix contains "some exercises for experimental study of soils and other factors of plant growth."

A new kind of garden school, MARY L. BUTLER (*Gard. Mag. [New York], 2 (1905), No. 3, pp. 132–134, figs. 11*).—A description is given of the garden school which has been conducted under private control during the past 3 years at Yonkers, N. Y. An itemized statement is made of the cost of conducting the school during the summer of 1904.

The present status and future development of domestic science courses in the high school, ELLEN H. RICHARDS (*Fourth Yearbook Nat. Soc. Sci. Study Ed., 1905, pt. 2, pp. 39–52*).—In addition to a discussion of the nature and extent of domestic science teaching suitable for high schools, the author gives an outline for a 4-year high school course in domestic science "based upon at least 3 years' work in the grades in which evident facts and manual skill have been acquired."

This course provides for instruction 2 to 4 hours weekly during the first and second years, 2 to 6 hours weekly during the third year, and 4 to 6 hours weekly the fourth year on the following subjects: Hygiene, physiology, drawing, textiles, physics, economic botany, general chemistry, preparation of foods, foods for the sick, balanced ration, biology, sanitation and civics, economics, and drawing and design as applied to house plans and decoration, with some experiments and library work.

Housekeeping schools for farmers' daughters, J. I. BRITTAIN (*Mo. Consular Rpts. [U. S.], 1905, No. 296, p. 133*).—Traveling schools for the instruction of girls in nutrition and related branches of home economics are in operation in some of the German provinces, and it is proposed, according to the author, to establish such schools in Alsace-Lorraine.

MISCELLANEOUS.

Eighteenth Annual Report of Arkansas Station, 1905 (*Arkansas Sta. Rpt. 1905, pp. VIII + 99*).—This contains the organization list; a brief statement of the director; a financial statement for the fiscal year ended June 30, 1905; and reprints of Bulletins 83–87 of the station, on the following subjects: Broom corn suggestions (E. S. R., 16, p. 560); peanuts (E. S. R., 16, p. 560); cotton food products in hog feeding (E. S. R., 17, p. 280); asparagus and salt (E. S. R., 17, p. 251); asparagus-growing in Arkansas (E. S. R., 17, p. 251); rhubarb in Arkansas (E. S. R., 17, p. 253); fertilizers registered for sale in Arkansas during 1905 (E. S. R., 17, p. 229); and glanders of horses (E. S. R., 17, p. 594).

Twelfth Annual Report of Minnesota Station, 1904 (*Minnesota Sta. Rpt. 1904, pp. XIII + 281*).—This contains the organization list; subjects of bulletins issued during the year; a report of the director on the work of the station and experiment farms during the year; and reprints of Bulletins 83–86 of the station on the following subjects: Apples and apple growing in Minnesota (E. S. R., 15, p. 473); insects,

injurious, in 1903 (E. S. R., 15, p. 1089); glutenous and starchy wheats (E. S. R., 15, p. 1095), composition and bread-making value of flour produced by the roller process of milling (E. S. R., 15, p. 1095), the relative protein content of wheat and flour (E. S. R., 15, p. 1096), composition of an ancient Egyptian wheat (E. S. R., 15, p. 1073), influence of storage and bleaching upon flours (E. S. R., 15, p. 1097), the relative food value of graham, entire-wheat, and straight-grade flours (E. S. R., 15, p. 1098); the food value of sugar (E. S. R., 15, p. 1098), the digestive action of milk (E. S. R., 15, p. 1099).

Annual Report of South Dakota Station, 1905 (*South Dakota Sta. Rpt. 1905, pp. 11-32*).—This is a report of the director of the station including a financial statement for the fiscal year ended June 30, 1905, and supplemented by departmental reports, some of which are noted elsewhere.

Accessions to the Department Library, April-September, 1905 (*U. S. Dept. Agr., Library Buls. 56, pp. 76; 57, pp. 47*).

NOTES.

Arizona Station.—F. W. Wilson, of the Kansas Agricultural College, has been appointed in charge of the department of animal husbandry, which position has been vacant for some time. His duties will include the organization and conduct of farmers' institutes for about three months each year. George E. P. Smith has succeeded S. M. Woodward, now of this Department, as irrigation engineer. About $10,000 was expended for improvements during the past calendar year. These included a residence and pumping plant at the Tempe cooperative date orchard, a residence and barn at the station farm in Phoenix, and a cottage on the new date orchard at Yuma.

Colorado Station.—Special field investigations in fruit growing will be made on the western slope of the State, with headquarters at Grand Junction. Two field men, one an expert horticulturist and the other an entomologist, will be in charge of this work. The orchardists in that section have experienced considerable trouble, and it is thought that the various problems can be best studied on the grounds. The work is to be carried on at the request of the fruit growers of western Colorado, who have raised $1,500 for the purpose. Drainage and seepage investigations will also be carried on in the same locality in conjunction with the other work. A. H. Danielson, who has been with the station for five years as assistant agriculturist, resigned January 1 to devote his time to private interests.

Idaho Station.—J. Shirley Jones, a graduate of the University of California, has accepted the position of chemist to the station, vice J. S. Burd, and entered upon his work January 1.

Louisiana Stations.—J. A. Verret has resigned to accept a position as manager of a sugar house in the Hawaiian Islands.

Massachusetts College and Station.—Hon. Carroll D. Wright, president of Clark College, has been appointed by the Governor a member of the board of trustees of the college, to succeed William R. Sessions, resigned. At a special meeting of the board of control W. P. Brooks was elected director of the station, the office being separated from that of president. The new horticultural building is nearly completed and is being occupied. Dr. C. A. Goessmann, formerly director of the State Station, has been elected honorary director of the station.

Michigan College and Station.—T. A. Farrand, in charge of the South Haven substation, has resigned to engage in business. A. G. Craig, instructor in horticulture, has accepted a similar position at the Washington College.

Minnesota University and Station.—The foundation for the new main building has been completed. It is 250 ft. long by 73 ft. wide, with a wing 73 ft. by 79 ft. on the east side. Provision was made for the erection of this building by the State legislature three years ago. When completed it will contain the offices of the dean, secretary, and principal of the school of agriculture; offices and laboratories for the departments of agriculture and entomology, and a number of class rooms for the general work of the school of agriculture. There will also be a chapel and assembly hall, and the library will occupy a prominent place on the first floor. The building is located on a tract of land adjacent to the main avenue of the campus, which was purchased mainly for this purpose. When completed it will greatly facilitate the work of both the college and station.

In order to promote the use of better seeds throughout the State, the school of agriculture has undertaken an educational seed-growing contest. Wheat, corn, and oats will be grown in competition for prizes, and the best seeds obtained disseminated for seed purposes. The movement is financed by the Minneapolis Chamber of Commerce, and it is the aim to give the contest as much of an educational feature as possible.

The farmers' clubs of the State, consisting of graduates and former students of the school of agriculture, have been holding a series of agricultural meetings recently. In many counties these clubs have been formed and are affiliated with a central organization. The programmes of the different meetings are arranged to meet the agricultural conditions of the different localities.

Nebraska University and Station.—Roscoe H. Shaw, for several years past assistant in the chemical department of the Kansas Station, has been appointed associate chemist in the station and assistant professor of agricultural chemistry in the university, vice Alvin Keyser, who has been transferred to assistant in soil investigations in the agricultural department of the university and station.

Oklahoma College and Station.—Four hundred and three students were enrolled in the week's course in stock judging and seed selection, given at the college January 9–15. H. J. Webber and W. J. Spillman, of this Department, gave lectures in connection with the course. The corner stone of Morrill Hall, the new agricultural building, was laid January 15, Hon. Rudolph Kleiner, president of the Oklahoma board of agriculture, delivering the address.

Pennsylvania College and Station.—At a recent meeting of the board of trustees it was decided to set off the respiration-calorimeter and other feeding work as a separate department, to be known as the Institute of Animal Nutrition, and to be in charge of a director. The dean of the college of agriculture and director of the experiment station will be combined in one officer, to be selected later. The Institute of Animal Nutrition will be a department of the college, affiliated with the experiment station. Dr. H. P. Armsby has been appointed director of the new institute, and upon the selection of a dean and director will be relieved of administrative work connected with the experiment station.

South Carolina Station.—At a recent meeting of the governing board, F. H. H. Calhoun of the college was elected geologist of the station.

Virginia Station.—It is noted from press reports that a bill has been introduced into the State legislature providing an annual appropriation of $10,000 for the experiment station, and regulating the expenditure of the appropriation.

West Virginia Station.—Frank F. Grout, assistant chemist, has resigned to take up work at the University of Illinois in connection with the geological survey and the engineering experiment station.

Wyoming University and Station.—The third annual short course at the university closed on January 13. The attendance was good, and the block demonstrations brought out some interesting data in regard to feeding lambs on various rations of grain and native hay. The demonstration was conducted by D. A. Gaumnitz, of the Minnesota College of Agriculture.

The station has secured a new Polled Hereford bull to take the place of Polled Admiral, head of the herd, which died a short time ago. Some new breeding experiments with hogs have been inaugurated also.

Digestion experiments which have been conducted show a high digestibility for the alfalfa raised at the high altitude of the station (7,200 ft.). This fact in connection with the protein content, which is higher than that of the average alfalfa in other places, gives the hay a nutritive ratio of 1:3.2. With the shortness of season and dryness of climate, protein seems to increase in all crops.

The Graduate School of Agriculture.—The plan for the Graduate School of Agriculture, to be held under the auspices of the Association of American Agricultural Colleges and Experiment Stations, at the University of Illinois, July 2–28, 1906, has been approved by the committee on graduate study, and arrangements are now being made to carry it out. The Director of this Office will act as dean, and the faculty will consist of specialists drawn from the agricultural colleges and experiment stations and this Department.

Courses will be given in agronomy (including the physics, chemistry, and bacteriology of soils and field-crop production), horticulture (together with plant physiology and pathology relating thereto), breeding of plants and animals, and zootechny (with special reference to meat production). Every effort will be made in the choice of men and subjects to have the strongest possible presentation and discussion of the results recently obtained by research and capable of reduction to pedagogical form. Emphasis will be laid on the local facilities and environment to bring out the numerous advantages which the University of Illinois has to offer to such a school.

During five days in each week the forenoons will be occupied with lectures and the afternoons will be given to seminars and demonstration exercises, in connection with which there will be much opportunity for the consideration of the questions which naturally are uppermost in the minds of advanced students. On Saturdays conferences will be held on general topics in agricultural education, and excursions are planned to the stock yards and packing houses in Chicago, and to typical Illinois farms.

Public opening exercises will be held during an evening of the first week of the session, at which it is expected that addresses will be given by the Secretary of Agriculture, the chairman of the committee on graduate study, the president of the University of Illinois, and the dean of the graduate school. Other evening exercises, largely of a social character, will be provided for.

The school will be open to graduates of colleges and other persons recommended by college faculties as qualified to profit by advanced instruction in agriculture. All correspondence relating to membership in the school should be addressed to Prof. Eugene Davenport, Registrar, College of Agriculture, University of Illinois, Urbana, Illinois.

Conference on Irrigation Work.—A conference of 14 men connected with the irrigation and drainage investigations of this Office was held in Washington beginning January 16. The field men in attendance were all connected with the investigations of irrigation as related to dry farming, a new work for this Office and one which is assuming so much importance that it seemed necessary to have a special conference regarding the methods to be followed. All phases of the irrigation work were considered, however, with results of so much value that it is hoped to make these meetings a feature of each year's work hereafter, having as large a part of the force present as possible.

The various subjects considered were assigned to committees, which presented reports upon matters relating to the conduct of the investigations. Copies of these reports and an account of the meeting will be sent to all persons connected with the irrigation work, so that they will in a large measure share in the benefits of the conference. One important point decided upon was the publication of a series of manuals of popular, practical character upon the following subjects: (1) Manual of Irrigation Practice (Revision of Office Expt. Stas. Bul. 145); (2) A Manual of Canal Management; (3) A Manual of Water Measurement and Distribution in Irrigation; (4) Methods and Cost of Pumping Water for Irrigation; (5) The Construction of Farmers' Reservoirs; (6) The Irrigation of Sugar Beets; (7) The Irrigation and Drainage of Rice Fields (Texas and Louisiana); (8) Some Special Forms of Organizing Irrigation Enterprises; (9) The Terracing and Drainage of Hillsides; (10) The

Drainage of the Atlantic Coast Rice Fields; (11) Practical Information for the Settler in Irrigated Districts.

Order Relative to Government Printing.— The President has issued an order relative to the printing of the Government Departments, the character of material to be included in annual reports, etc. This order calls for the appointment by the head of each Executive Department of an advisory committee on the subject of printing and publications, in accordance with which Assistant Secretary W. M. Hays, Prof. Willis L. Moore, of the Weather Bureau, and Mr. Geo. Wm. Hill, chief of the Division of Publications, have been selected for this Department. "It shall be the duty of such committee, under direction of the head of the Department, to see that unnecessary matter is excluded from reports and publications; to see that copy is carefully edited before rather than after going to the printing office; to do away with the publication of unnecessary tables, and to require that statistical matter be published in condensed and intelligible form; to supervise the preparation of blank forms; to require the frequent revision of mailing lists; to prevent duplication of printing by different Bureaus; to exclude unnecessary illustrations from Department documents, and to prevent the printing of the maximum edition allowed by law, when a smaller edition will suffice; to recommend to the head of the Department, for inclusion in the recommendations contained in his annual reports, needed changes in the statutes governing Department publications."

The President has also directed that annual reports shall be confined to concise accounts of work done and expenditures incurred during the period covered, with recommendations relating to the future, and shall not include contributions to knowledge in the form of scientific treatises, material compiled by persons not connected with the reporting office, biographical and eulogistic matter, or detailed descriptions and lists of methods, processes, etc. The illustrations are to be much restricted, as are also tabular matter and texts of laws and court decisions.

Bills Before Congress.—The following bills of agricultural interest have recently been introduced: To require the Secretary of Agriculture to make monthly reports as to the long-staple cotton, pineapple, and orange crops; authorizing the Secretary of Agriculture to make experiments to eradicate splenetic or southern fever ticks, and appropriating $25,000 for the purpose; authorizing the Secretary of Agriculture to make experiments with a view to eradicating Texas fever, and appropriating $100,000 for the purpose; granting to the State of Minnesota certain lands to be set aside for experimental work in forestry; to prevent the adulteration of blue grass, orchard grass, clover, and alfalfa seed, and providing for inspection by the Bureau of Plant Industry; to enable the Secretary of Agriculture to examine and report upon the nature, quality, and condition of seed and grain, and appropriating $30,000; to further promote the dairy industry of the United States, appropriating $20,000 to be expended under the direction of this Department; authorizing the Secretary of Agriculture to make experiments and investigations in utilizing limited water supplies in connection with farming in the semiarid regions, and appropriating $30,000 for the purpose; and a bill providing for the segregation of $1,000,000 from the Reclamation Fund, to be used for constructing a system of land drainage in six counties of North Dakota, under the supervision of the Secretary of Agriculture, benefits to be assessed against the lands drained and to be returned to the fund.

The Adams bill for the increased endowment of the experiment stations was reported January 15, and at that time Mr. Adams submitted a statement briefly setting forth in admirable terms the present position of agricultural experimentation in relation to the development of agriculture, the great value of the experiment stations, and the need of further appropriation, which has grown out of their work.

Agricultural Experimentation in Russian Poland.—A recent issue of *Die landwirtschaftlichen Versuchs-Stationen* (Vol. 63, No. 1-2) contains a historical account of agri-

cultural experimentation in Russian Poland. From this it is learned that in 1876 a chemical laboratory was established in the Warsaw Museum of Industry and Agriculture, and in 1880 a botanical section with a seed-testing station. In 1886 an agricultural experiment station was founded in Sobieszyn through the generosity of Count K. Kicki, who gave his whole fortune to the promotion of agriculture. The laboratories were enlarged in 1892, the experimental fields rearranged, and a plant-breeding garden laid out.

This remained the only experiment station until a group of agriculturists in the government of Plock established the agricultural experiment station of Chojnowo, which was moved to Hruszczewo in 1904. In the same year representatives of the sugar industry established a station in Grodzisk, which four years later was moved to Jezowka. An experiment station for the brewing industry was started in Warsaw in 1898. The following year the agriculturists of the government of Warsaw located an experiment station at Kutno, to which an experimental field at Lenczyca was added in 1902. An experimental field was also established under private auspices at Chmilnik in 1902. Through the efforts of the Agricultural Society of Warsaw the agricultural laboratory was opened in Warsaw in 1901, and in 1903 a station for the testing of agricultural machinery and apparatus, and a station for plant protection were established at the same place. An experimental field was also started at Piastow in the same year.

The experiment stations and fields of Russian Poland, therefore, owe their origin and support entirely to private enterprise, none of them receiving any aid from the government. The directors of the stations formed a society in 1902 and adopted uniform methods of analysis for soils, fertilizers, and seeds, which have been accepted by the local fertilizer manufacturers and seed dealers.

Experiment Stations in France.—The Minister of Agriculture in a recent report to the President of the Republic calls attention to the inadequacy of the French system of agricultural research as compared with similar institutions in Germany, Austria, and the United States. The Minister has therefore appointed a committee on the organization and improvement of agricultural investigation in agricultural experiment stations and laboratories. This committee is composed of 65 members, including officers of the Department of Agriculture, directors of agricultural schools, senators, deputies, members of the National Agricultural Institute, and of the National Agricultural Society, besides other men of note in the agricultural world.

An entomological station has recently been established in connection with the zoological laboratory of the Faculty of Sciences at Rennes, under the directorship of F. Guitel.

A New Station for Testing Agricultural Machinery.—The commission for testing machinery connected with the Chamber of Agriculture of the Province of Hanover, at its meeting May 12, 1905, resolved to enlarge its functions by the establishment of a machine-testing station, to be in charge of Prof. Alwin Nachtweh.

Prize for Work on the Value of Calcium Phosphate in Feeding.—The Mecklenburg Patriotic Society has offered a prize of 1,500 marks (about $360) for a treatise upon the question, Is the Feeding of Calcium Phosphate Advantageous? Experiments, including digestion trials, are to be made with ruminants, pigs, and horses, and the reputed effect of this material on the strength of the bones is to be studied. The question as to whether the same results can not be secured with calcium carbonate is also to receive attention. The competition for this prize closes September 15, 1908.

American Association for the Advancement of Science.—This association held its fifty-fifth annual meeting at New Orleans, Louisiana, during the week beginning December 29, 1905. As usual, a number of affiliated societies met with the association. The attendance was smaller than usual, there being but about 300 delegates and visitors present. A large number of papers and addresses of popular and scientific interest

were presented, many of them dealing with different phases of agriculture. The more important of these are noted below.

The address of the retiring president, Dr. W. G. Farlow, was upon the subject of The Popular Conception of the Scientific Man at the Present Day. Dr. Elwood Mead, of this Office, gave a public address on the subject of irrigation, illustrating his address with an excellent collection of stereopticon views of Egyptian, Italian, and American irrigation. It was considered that irrigation in Egypt represents primitive irrigation, the success of which is not the result of superior methods but of the marvelous fecundity of nature, while that of Italy, on the other hand, represents the highest achievement of engineering skill in the utilization of resources in land and water and the perfection of laws and customs governing the use of water. The greater part of the address was devoted to the development and present status of irrigation in the United States.

The association adopted resolutions to Congress looking toward the preservation of Niagara Falls as a National park and the establishment of the Southern Appalachian Forest Reserve. Dr. W. H. Welch, of Johns Hopkins University, was elected president of the association. It was decided to hold the next summer meeting at Ithaca, N. Y., and the winter meeting in New York City.

American Chemical Society and Section C.—F. P. Venable, president of the American Chemical Society, in his address on Chemical Research in the United States, reviewed the progress of chemical research in this country and plead for more original work.

L. P. Kinnicutt, in an address on The Sanitary Value of Water Analysis, discussed the value of chemical and bacteriological examinations in detecting pollution of surface, ground, and artesian waters. It was considered that the bacteriological examination, while giving information as regards recent and continuous pollution, gives no information as to the past history of a water and in this respect differs from a sanitary chemical analysis. Hence an opinion concerning the wholesomeness of a water should be based upon all the information obtainable about it.

H. W. Wiley discussed Some Important Problems in Agricultural Chemistry, touching among other things upon problems relating to plant food, cider investigations, preservation of food products, and nutrition investigations.

C. W. Browne, jr., read a paper on Recent Developments in Industrial Chemistry in the South, in which several industries were selected and described as illustrations of the great progress that is being made. Special reference was made to the manufacture of sulphuric acid and of ice, preservation of timber, utilization of pine and bagasse in paper making, extraction of rice oil, introduction of improved varieties of sugar cane, and manufacture of alcohol from molasses.

The committee on uniformity in technical analysis submitted a report which showed opportunities for improvement in analytical work in this country. Samples of argillaceous limestone were submitted to a large number of analysts throughout the United States, the results reported showing decided want of agreement in many of the determinations, especially Al_2O_3, MnO, and Na_2O.

A paper on the Filtration and Purification of the Mississippi River Water at New Orleans was read by J. L. Porter. The problem was considered one of engineering, requiring the removal of 100 tons of mud daily from the 4,000,000 gal. of water necessary to supply the needs of the city of New Orleans. The most satisfactory treatment was found to be preliminary subsidence for 12 hours, coagulation with sulphate of alumina, and filtration. Softening of the water by the use of lime was also considered desirable.

The Availability of the Phosphoric Acid of the Soil was discussed in a paper by G. S. Fraps. The use of water, carbonated water, 1 per cent acetic acid, and two-hundredth normal hydrochloric acid as solvents was considered unsatisfactory. A

relation was observed between the chemically available phosphoric acid and soil deficiency in phosphoric acid, as shown by pot tests in a number of soils. Cotton and cowpeas were found to render more of the phosphoric acid of the soil available than rice or corn.

The same author presented a paper on The Effect of Climate on the Composition of Cotton Seed. Observations made during two seasons showed that cotton-seed meal from the western part of Texas, where the climate is semiarid, was richer in nitrogen than meal from the eastern part of the State. Texas cotton-seed meal was considered richer than cotton-seed meal from other sections.

The Fermentation of Sugar Cane Products was the subject of a paper by C. W. Browne, jr. Various changes brought about in sugar cane by enzyms and micro-organisms were described. The number of micro-organisms producing decomposition of sugar-cane products was considered almost unlimited. The most common fermentation of the raw juice in Louisiana is a fermentation designated as viscous, mucilaginous, or mannitic. The gum produced in this fermentation and known as dextran was believed to be either a hydrated product or a polysaccharid isomeric with either raffinose or stachyose. A fermentation in Louisiana resulting in the formation of cellulose from sugar was described. Both the dextran and cellulose resulting in the above were believed to be assimilation products rather than true fermentation products.

The scum forming on molasses in hot rooms was found to contain in one instance 27.5 per cent of fat which agreed very closely in its physical and chemical constants to butter fat. Its distinguishing characteristics from butter fat were the high degree of acidity and the greater preponderance of such acids as caproic and caprylic. Reference was also made to the common occurrence of dimethyl ketol, or acetyl-methyl carbinol, which compound was believed to be always produced in small amounts whenever the alcoholic fermentation was arrested through the development of oxidizing or acid-producing bacteria.

In a paper on The Quantitative Determination of Salicylic Acid, by W. D. Bigelow and W. L. Dubois, an attempt was made to define as exactly as possible the conditions to be followed in the estimation of salicylic acid, by extracting the organic solvents and comparing the color given with ferric solutions with that of solutions containing known amounts of salicylic acid. It was believed that with proper precautions results can be obtained which are reasonably accurate.

Papers on the Ripening of Oranges and Persimmons, by W. D. Bigelow, H. C. Gore, and B. J. Howard, were presented in abstract form. Oranges increase in actual weight of total solids and sugars from the beginning to the full maturity of the fruit. At all stages of the growth of the fruit, the total sugars are divided about equally between reducing sugar and sucrose. The marc of the orange is formed very early in its history and remains constant in weight during its growth and development. The acids are also formed at an early stage and apparently increase gradually but almost imperceptibly.

Storage of the fruit at all stages of its development results in slight loss of total sugar, a marked increase of reducing sugar, and a corresponding loss of sucrose. The loss of total sugar is to be explained by the consumption of reducing sugar as a result of the respiration of the fruit. The weight of marc remains practically constant, and the weight of acid appears to decrease slightly on storage during the various stages of the development of the orange.

The weight of the pulp of persimmons increased steadily during the entire period of observation, and a marked increase was also noted in the case of total determined solids, sugar, and marc. The sugar was found to consist almost entirely of invert sugar. The amount of sucrose was apparently almost within the limits of analytical error. The percentage of acids was also very low. During a later portion of the

period of observation, the tannin was found to decrease in proportion to the increase in the weight of the marc.

The tannin is not decomposed and does not actually disappear in the ripening of the fruit, but is converted into an insoluble form by a change of its constitution or composition, or by its combination with some substance of very low molecular weight within certain specialized cells. No evidence was found of the combination of tannin with any other body in the formation of this insoluble compound. The changes occurring on storage were similar to, but more rapid than, those occurring in the natural ripening of the fruit. Decreases were found in the solids and sugar of the stored fruit, while the weight of marc in the fruit was found to increase owing to the tannin becoming insoluble.

A paper on The Cotton Oil Industry of the South, by D. Schwartz, dealt with the pressing, refining, grading, and uses of cotton-seed oil. It was estimated that 75 per cent of the annual production of 120,000,000 gallons of oil is used for food purposes.

J. H. Long reported Investigations on Salts of Casein. He endeavored to determine by physical methods certain constants which might be considered as characteristic of casein from the milk of different species. The determinations made were (1) the equivalent weight by titration with $\frac{1}{10}$ alkali, using phenolphthalein as an indicator, (2) the electrical conductivity of the salt solution so obtained and of salt solutions made with half this amount of alkali, (3) the optical reduction of the salt solutions, and (4) the behavior of the casein on digestion with pepsin and hydrochloric acid, and the changes in the conductivity of the digesting mixtures. Determinations on casein prepared from cows', goats', and human milk were reported. Considerable differences were found in the equivalent weight of casein from goats' and cows' milk.

F. C. Weber reported experiments on The Influence of Salicylic Acid on the Excretion of Urea and Uric Acid, showing that salicylic acid given in quantities of $\frac{1}{4}$ to $\frac{1}{2}$ gm. daily did not increase the excretion of urea and uric acid to the extent claimed by many investigators.

F. G. Benedict, in a paper on The Cutaneous Excretion of Nitrogenous Material, stated that the cutaneous elimination of nitrogenous material in a healthy man amounted to about 71 milligrams per day. A man subjected to heavy labor showed an elimination of 220 milligrams per hour, which rate could be maintained for 6 hours. The experiments indicate that this channel of elimination can not be ignored in studying nitrogen metabolism.

A paper on The Effect of Alcohol on the Secretion of Bile, by W. Salant, was presented in abstract and indicated that moderate amounts of alcohol are helpful to digestion, while large amounts are injurious.

Among the other papers on the programme, many of which were read merely by title, were the following: Recent Experimental Researches on Osmosis, by L. Kahlenberg; Laboratory Designing and Construction, by W. L. Dudley; Separation of Solutes from Solvents by Absorbing Media, by F. K. Cameron and J. M. Bell; Molecular Absorption, by F. K. Cameron and B. E. Livingston; Absorption of Potassium, by O. Schreiner and G. H. Failyer; Absorption of Phosphates from Solutions, by O. Schreiner and G. H. Failyer; Electrolysis and Endosmosis in the Study of Rock Decomposition, by A. S. Cushman; A Method for the Determination of Small Amounts of Copper in Water, by E. B. Phelps; A Trade Waste Study: Copper Salts in Irrigation Waters, by W. W. Skinner; On the Presence in Soils and Subsoils of Substances Deleterious to Plant Growth, by F. K. Cameron and B. E Livingston; The Estimation of Hydrocyanic Acid in Cassava, by C. C. Moore; Artificial Coloring Matter in Whiskey, by P. H. Walker; A Uniform Method for the Determination of Dextrose and Invert Sugar, by P. H. Walker; The Extraction of Tanning Materials for Analysis, by F. P. Veitch and H. H. Hurt; The Dextrose Equivalent in

Saturated Cane Sugar Solutions and its Application in the Extraction of Sucrose, by L. W. Wilkinson; The Relation of Carbon Dioxid Excretion to Body Weight, by G. O. Higley; The Separation of Proteoses and Peptones from the Simpler Amido Bodies, by W. D. Bigelow and F. C. Cook; Studies on the Banana, by L. B. Mendel and E. M. Bailey; Use of Porcelain Dishes in Silicate Analyses, by F. L. Kortright; The Determination of Silica, by N. Knight; Solubility of Gypsum in Solutions of Ammonium Sulphate, by J. M. Bell and W. C. Taber; and Solubility of Gypsum in Solutions of Magnesium Sulphate, by F. K. Cameron and J. M. Bell.

Through the personal efforts of C. W. Browne, jr., and R. E. Blouin, of the Sugar Experiment Station at Audubon Park, and C. E. Coates, of Baton Rouge, very pleasant and profitable excursions were made by the visiting chemists to acid and fertilizer works, the Sugar Experiment Station, Kenilworth Plantation, Henderson Sugar Refinery, and the National Rice Mills.

Botanical papers.—Of the botanical papers presented few were of special interest in their direct bearings upon agriculture. The Preparation of Nontoxic Distilled Water was described by B. E. Livingston, and The Leaf Anatomy of Some Desert Plants, by F. E. Lloyd. A paper by D. T. MacDougal reported investigations on the origin of species. Various chemical solutions were injected into ovaries just before the flowers opened. Seeds maturing in ovaries so treated produced, in many instances, plants which showed a marked variation from the parental type.

The Botanical Society of America, the American Mycological Society, and the Society for Plant Morphology and Physiology were consolidated under the name of Botanical Society of America.

Section F, Zoology.—C. H. Merriam, vice-president of the association and chairman of the section, delivered an address on the subject, Is Mutation a Factor in the Evolution of the Higher Vertebrates? In a study of more than a thousand species and subspecies of North American mammals and birds no evidence was found in support of the theory of the origin of species by mutation. A Mendelian Character in Cattle was the title of a paper by W. J. Spillman. The other papers before this section were not of particular agricultural interest.

Social and Economic Science.—There were three well-attended sessions of Section I on social and economic science, one of which was devoted to papers on agricultural problems, one to educational and sociological matters, and one to railway questions.

At the session devoted to agriculture, Judge Eugene Williams, of Texas, presented a paper on The Possibilities of Cotton Warehousing from the Producers' Standpoint. He advocated the erection of warehouses by the cotton producers so that the raw product might remain in the district of production until actually wanted for use. This arrangement would protect the cotton from the elements and do away with present unbusinesslike methods of handling. The cotton grower would be enabled to sell directly to the manufacturer instead of through a middleman.

The benefit to the farmer from the adoption of this plan, which is heartily indorsed by the Southern Cotton Growers' Association and Farmers' Union, was estimated at $100,000,000 annually. Damage by exposure alone is estimated at from 50 cents to $1 per bale, or $5,000,000 to $10,000,000 annually for the total crop. An instance was cited in which cotton thus housed and sold in bulk brought from $\frac{1}{8}$ to $\frac{1}{5}$ cent per pound, or 60 cents to $1 per bale, more than if sold by the single bale from the farmer's wagon. To give confidence to the farmers the warehouses should be within easy distance and have a capacity of about 1,000 bales, rather than erect larger houses in cities. The local warehouse would add increased deposits in the local banks and encourage cotton mills in the cotton belt.

In the discussion of this paper Le Grand Powers stated that less care is exercised in the production and handling of cotton from the producer to the consumer than any other farm crop, and that proper handling would add at least one-third to the farm price and farm value of the crop.

A paper entitled Factors Determining the Price of Sugar was read by F. R. Rutter. He discussed principally the deviations in the price of sugar in the United States from the world price. The price of raw sugar at New York, after paying shipping charges and import duties and allowing for difference in grade, is frequently lower than the price of sugar at Hamburg for exportation. This decline is most marked from December to June of each year, due to the heavy imports of Hawaiian and Cuban sugar, which, together with the Louisiana output, more than suffices for the current need of refiners. The temporary excess in the supply results in a temporary reduction in domestic prices below the parity of the world price. From July to December recourse is necessary to sugar subject to the full tariff rates, especially Java and German sugar.

Louisiana is under a special disadvantage, since 80 to 85 per cent of its total output is sold in November, December, and January when the price paid for refined grades is 13 to 19 cents per 100 lbs. less than the New York quotations, due to shipping charges. The reduction in the price of raw sugar below what is termed the normal affects only indirectly, if at all, the price of refined. The price of refined sugar in New York is usually kept materially above the cost of imported German granulated sugar after allowing for shipping charges.

W. R. Dodson addressed the section on the Utilization of the By-products of the Cane Sugar and Rice Mills. The process of manufacture by which rice hulls, rice bran, and rice polish are obtained was described, and the value of these various materials for stock feeding and other purposes was discussed. One bag of rice was stated to yield from 8 to 10 lbs. of rice polish and about 30 lbs. of rice bran. From the total rice crop of Louisiana about 24,000,000 lbs. of rice polish, worth about $375,000, and 90,000,000 lbs. of bran should be obtained.

Much of the rice polish is exported to Germany and manufactured into buttons and sundry small articles. In Louisiana it is extensively used as a feeding stuff. As the result of investigations made to show the feeding value of rice bran, the price has risen from $4–$6 per ton to $14–$15. The value and use of molasses as a feeding stuff was discussed in considerable detail. This material is now widely used to bring up the carbohydrate portion of rations unusually rich in protein.

A paper on Teaching Agriculture in Rural Schools was presented by W. F. Massey. He stated that as at present constituted our rural schools do not prepare students for courses in agriculture. This preparatory work must, therefore, be done by the agricultural college, as a result of which it requires 4 years to do 2 years real college work. School gardens were considered of great usefulness in cultivating habits of industry and respect for labor. The great problem at the present time is to enthuse and train teachers for the work, encouraging to the utmost the capable ones already interested in teaching.

The Relation of Forests to Soil and Climate was discussed by W. R. Lazenby. Because of the destruction of forests nine-tenths of Ohio is required to produce what three-fourths of the State formerly did; soils rapidly lose their summer moisture; springs and wells are failing; streams and rivers are more variable in their flow; droughts are more severe and floods more common. European experience was cited to show that from one-fourth to one-third of any considerable area should be occupied with trees. In Ohio the ratio of wooded to cleared land is about 1 to 10, and the forests are still being removed.

It was urged that land which can not be cultivated or is now cultivated at a loss be set aside for timber growing, and that for every tree cut down two better ones be planted until one-fourth of the area of the timber-growing sections of the United States be restocked with trees. It was argued that if the efforts of farmers were concentrated on smaller areas larger, better, and more remunerative crops would be secured.

Miss Louise K. Miller delivered an illustrated lecture before the section on School Garden Work in Cleveland, which was stated to be the outgrowth of the efforts of the Home Gardening Association. School gardening now constitutes a regular department of the Cleveland city schools. Last year the schools sold 250,000 penny packages of seed to the school children of the city, reaching some 50,000 homes. The school children are given instruction in the laying out of gardens, preparation of soil, use of fertilizers, methods of planting seed, making cuttings, constructing hotbeds, habits of injurious and beneficial insects, etc.

Society for Horticultural Science.—The number in attendance at the New Orleans meeting of the society was small, but a large number of unusually interesting papers were presented.

The presidential address by Prof. L. H. Bailey dealt with the recent progress in American horticulture, covering the period since 1902. This progress, Professor Bailey held, had been largely along the line of further development of work already established, rather than in the projection of entirely new lines. Distinct progress has been made in teaching agriculture in schools and in presenting horticulture and country-life subjects to the people in an attractive way by means of periodicals and books. There have been published during the past three years nearly 600 bulletins on horticultural subjects.

In technical horticulture plant breeding is occupying unusual attention. The work of Mr. Burbank was characterized as remarkable and significant, but often sensationalized and overstated.

Many new horticultural regions, particularly trucking in the Gulf coast and fruit-growing in the west and northwestern States, are being developed. Fruit fully mature but still firm has been found to keep longer and better in cold storage than green or immature fruit. The large losses of citrus fruits in California by decay have been found to be due to carelessness in clipping the stems and delay in putting the fruit into storage.

In a comprehensive paper on Light as a Factor in Plant Culture, V. A. Clark discussed the effects of various colored lights, of direct and diffused sunlight, and of various artificial lights on the growth of plants. The red rays of the spectrum in general promote vegetative growth, particularly that of the leaves, while the more refrangible blue rays act upon the molecular structure of the plant, giving rise to mutations. In arid regions direct sunlight is injurious to many plants and the successful culture of such plants depends upon furnishing them with partial shade.

Leaf growth is largest and tenderest in light of rather low intensity, a fact which suggests the desirability of growing salad plants in partial shade, or better still in red light. From observations in Arizona it is believed that the intensity of direct sunlight is greater than the intensity most favorable to bud formation, and that better results would be obtained with very light shading on the south and southwest sides of fruit trees. A sorghum hedge was found too dense for this purpose and the use of sesbania, a native tall, thinly branching herb, was suggested. Volatile oils appear to develop best in red light. Hence, flowers grown for fragrance might be grown in a combination of red and blue light.

Strong light has been found in some instances to inhibit the growth of pollen tubes. This is thought to be the reason why tomatoes and cucumbers do not bear fruit in midsummer in Arizona. Strong direct sunlight in summer also prevents chlorophyll formation. Thus, strawberries in Arizona are yellow for about three months in summer even when grown under shade of cheese cloth. When grown on the north side of a dense shade of sorghum or cotton the plants remained green and dense all summer and were the most vigorous in the garden. It was believed that the matter of shading is of greater horticultural importance in arid regions than fertilization is in the East. The paper contained a number of suggestions on methods of analyzing light and methods of growing crops under partial shade.

L. C. Corbett presented a paper on Horticultural Botany. This should give us uniform detailed descriptions of our cultivated varieties of fruits, vegetables, and ornamental plants, together with a systematic classification and arrangement of such varieties. In a description of horticultural varieties such matters, in addition to the usual descriptive notes, should be included as the history of the variety, its parentage and line of descent, and its behavior in breeding experiments—whether possessing a dominant or recessive character, etc.

The Irrigated Orchards of the Western States formed the subject of a paper prepared by M. B. Waite. This pointed out the increasing importance of orcharding in the Rocky Mountain Plateau and the adjacent arid regions of the western half of the United States, and called attention to some of the differences between these sections and the humid eastern United States. Large orchard plantings, particularly of apples and peaches, have recently been made in Colorado Utah, Idaho, Montana, and New Mexico, more especially on the western slope of the Rocky Mountains and around the Great Basin at elevations of 4,000 to 6,000 feet. The important characteristic of these orchard regions is the absence of rain during the growing season, accompanied by a very low atmospheric humidity. These conditions exert a marked influence on the texture, quality, and appearance of the fruit. Apples have a beautiful wax-like color. The varieties grown are mostly of the better sorts, such as Jonathan, Rome, Winesap, etc.

The irrigated orchards of these regions are among the healthiest and thriftiest in the whole country. The air is so dry that ordinary blights and leaf spots are seldom injurious. Pear blight, however, is often more severe than in the East. Root diseases are quite prevalent, and certain insects like the codling moth are unusually serious. The orchards are unusually productive, a good crop of fruit being secured practically every year. This feature is helping a great deal in the commercial success of the industry.

Some interesting observations were forwarded to the society by W. Paddock. From some experiments made at the Colorado Station he questions whether eastern potato scab may not be due to Rhizoctonia rather than to Oospora. He suggests that Oospora may often be a parasite upon Rhizoctonia and not actually concerned in the scab at all. It is believed that the whole subject of potato scab is very much in need of investigation. In Colorado the scab, which appears to be due to Rhizoctonia, is much more severe in land which is lacking in decaying vegetable matter. A few crops of alfalfa turned under largely corrects this tendency.

N. E. Hansen gave an interesting account of a visit to Luther Burbank. Burbank was said to make constant use of the principle laid down by Darwin that excess of food causes variation.

U. P. Hedrick presented the results of an experiment designed to test the effects of superheated soils on plants. The work was carried out in a greenhouse on cucumbers. Bottom heat was supplied in bench beds, the soil of one section being kept at an average temperature of 70.8° during one experiment, a second section at 73.8°, and a third section at 83.3° F. The plants in the soil kept at the highest temperature came up about 3 days earlier than those kept in the bed at medium temperature and 6 days earlier than those in the bed kept at the low temperature. There was about the same difference in time in the formation of true leaves.

The plants bloomed in the hot bed in 35 days, in the medium hot bed in 39 days, and in the cold bed in 44 days. The first mature fruits were picked from the hot bed in 74 days, from the medium hot bed in 77 days, and from the cold bed in 82 days from seeding. The average number of fruits was slightly more in the medium hot soil and they were a little larger than in either of the other beds.

Commenting on these results Professor Hedrick stated that they represented but one experiment, only 12 plants were used in each bed. There was much variation in the behavior of individual plants in the same bed, and there was a slight difference

in the position of the beds. So far as he knew the results represented the first recorded work along this line designed to secure definite data regarding the best soil temperature at which to grow various greenhouse crops. All that is available at present is the dogmatic assertion of gardeners that this or that plant should have brisk or mild heat or none at all.

H. P. Gould forwarded a paper on the Significance of Fruit Surveys. He considered a fruit survey as involving "a study of varieties with special reference to their requirements; a study of conditions with special reference to this influence on varieties; a correlation of the factors brought out in these two lines of investigation with regard to cause and effect." A commercial fruit grower no longer asks for a best variety, for in its broad sense it is known not to exist, but rather for a variety which will best serve a particular purpose under definite known conditions. A fruit survey should furnish information along these lines.

Scientific Problems Confronting the Horticulturists of Louisiana was the title of a paper presented by F. H. Burnette. The desirability of breeding up later and more hardy varieties of fruits was emphasized. Breeding experiments with apples seem to indicate that varieties will be secured by this means which are adapted to the needs of Louisiana growers. More early pecans are needed. The control of fungi is a serious problem in Louisiana and resistant varieties are needed. Some oaks have been found upon which mistletoe has not been able to gain a foothold. Seedlings of these are being grown to see if this character can be perpetuated.

A paper by David Fairchild was presented on The Japanese Method of Ripening Persimmons, from which it appears that the ripe persimmons grown according to the Japanese method are as firm in texture as a Northern Spy apple, free from astringency, and of a delicious flavor. Investigations as to methods of curing ripe persimmons show that the Japanese put the persimmons in sake (Japanese beer) casks as soon as the casks are emptied. The heads of the casks are immediately replaced and the package made air-tight. In from 5 to 15 days, according to weather conditions, the persimmons are cured and can be removed and marketed, keeping in a firm, edible condition for a long period.

It was believed that if Americans wish to cure persimmons according to the superior Japanese method it would be advisable to make casks of southern cypress and saturate them with first-class sake imported from Japan. Casks containing sake which has been fortified with alcohol or other spirits have been found useless for the purpose of curing persimmons.

A paper entitled Forcing Rhubarb in the Dark was presented by W. R. Lazenby. The main point brought out was the very satisfactory results that may be secured by growing the roots from seed and forcing when 1 year old. Drying the roots was found to have about the same effect as freezing. Either drying or freezing serves the same purpose as a long rest, which is otherwise required, and the growth is more vigorous. When thus grown in darkness the leaf blade is greatly reduced, the green color is wholly absent, the texture is more crisp and delicate, due to a lessened development of woody fiber, the skin is much thinner than when grown in light, the water content is increased 6 to 10 per cent, and the flavor is generally improved.

C. B. Smith gave a Review of Horticultural Progress in France, in which he summarized the experimental data that have appeared in that country during recent years on such subjects as the etherization of plants, methods of pruning by disbudding, and the results secured in the culture of the Uruguay potato (*Solanum commersonii*).

T. V. Munson presented a paper on Improvement of Quality in Grapes, considering the subject from the standpoint of improvement by cultivation, by selection of kinds, and by breeding or hybridization. Much the larger part of the paper was devoted to the latter phase of the subject. Work of this kind necessitates an accurate knowledge of the characteristics of each of the 16 species of grapes and of the

many kinds of varieties that have been developed. Mr. Munson described his own methods of work in the field, illustrating the subject by a detailed account of the production of the variety Brilliant in which the Delaware and Lindley varieties were used as parents, the work being done along well-known lines.

Association of Economic Entomologists.—The society had a three days' meeting at New Orleans, beginning January 1, which was well attended. The programme was a long and varied one.

President H. Garman of the society was unable to attend the meeting, but sent a carefully prepared paper on The Scope and Position of Economic Entomology Among Branches of Biology. He maintained that as a culture study and for memory training entomology surpasses the dead languages, and should have a coequal place in schools and colleges with botany. The relation of insects to human and animal diseases, he argued, should be worked out by the entomologists, and not left to physicians and veterinarians. The desirability of using honey bees in class room work in all agricultural colleges was urged, and it was suggested that the entomologists should take the lead in teaching the silkworm industry in this country. State inspection work should be placed in the hands of trained entomologists and the nursery inspection laws of the States made more uniform. Special attention was called to the desirability of giving more study to the relation of insects to the distribution of plant disease, and to the production of flowers, fruits, etc. A point brought out in the discussion of this paper by S. A. Forbes was that apples sprayed with arsenic kept much better in cold storage than unsprayed apples.

In a paper on The Corn Root Aphis and Its Attendant Ant, Prof. S. A. Forbes gave an elaborate account of the life history of the aphis, showing its dependence upon ants for spread and injuriousness, and brought out the fact that in treating it rotation and extra cultivation should be the prime factors.

Prof. E. D. Sanderson read a paper on National Control of Introduced Insect Pests, in which he suggested that the association take action looking toward the national control of introduced insect pests.

One of the most important sessions was devoted to a symposium on the boll weevil in which W. D. Hunter discussed The Present Status of the Mexican Cotton Boll Weevil; W. E. Hinds, Laboratory Methods in the Boll Weevil Investigation; and W. Newell, The Work of the State Crop Pest Commission of Louisiana on the Cotton Boll Weevil. A. F. Conradi had a paper on The Cultural System in the Light of Recent Observations Regarding the Boll Weevil. In general, it was believed that while the progress of the insect could be temporarily checked it could not by any means now at hand be stayed, and that the weevil would eventually infest the entire cotton-producing region of the United States.

It was brought out that the cotton leaf worm, which was at one time classed as a dangerous enemy to cotton, might be useful as an ally against the boll weevil, since if allowed to develop at the end of the season it would strip the plant of all green material, necessitating the early hibernation of the weevils. If the stalks of the plants are then gathered and burned large numbers of weevils will be destroyed. Chief reliance, however, must be placed in the use of early-maturing varieties, thorough cultivation, and such cultural methods as will hasten the crop to maturity as early in the season as possible.

In the report of W. E. Hinds on Some Breeding Experiments with Boll Weevils in Cages Kept at Different Temperatures, it was shown that it is possible to predict the number of broods that may be expected in a given locality provided weather records are obtainable. It was thought further that this method of breeding at different temperatures might be applied to other insects in predicting their development in new localities where weather records were known.

W. E. Britton discussed Methods of Destroying the Woolly Maple Leaf Scale by Spraying. This scale, *Phenacoccus acericola*, is now a serious pest of the sugar maple

street trees in Connecticut cities. Some badly infested trees began to drop their leaves in July. Two small trees and one medium-sized tree were sprayed August 4 with the ordinary kerosene emulsion diluted nine times. Results were unsatisfactory, few of the insects being killed. Some trees were sprayed again August 17 with kerosene emulsion made with a soft naptha soap and diluted five times, with satisfactory results.

The same speaker gave the results of Tests of Lime-Sulphur Washes in Connecticut in 1905. In this work 6,000 peach, pear, and apple trees were sprayed in March and April, 1905, with lime-sulphur washes prepared according to 5 different formulas, and with the kerosene-limoid mixture, containing 25 per cent of kerosene. The lime-sulphur washes gave more satisfactory results than the limoid mixture and were less expensive. No advantage could be detected by adding salt to the boiled wash. The self-boiled wash, containing 20 lbs. lime, 10 lbs. sulphur, 10 lbs. sodium sulphid, and 40 gal. water, was fully as effective as any of the boiled mixtures.

Grain Fumigation with Hydrocyanic Acid was the subject of a paper by H. E. Summers. He reported that in the fumigation of a seed warehouse of 300,000 cu. ft. capacity, 1 oz. of cyanid per 100 cu. ft. was used. The house was subjected to fumes of this strength over night, but it proved ineffective against *Calandra granaria* in the middle of bags of grain.

Another paper along similar lines was presented by C. L. Marlatt on The Use of Sulphur Dioxid as an Insecticide. He described an apparatus by means of which sulphur dioxid could be forced into buildings, and its penetrating power thus increased over the simple burning of sulphur in the building. Sulphur dioxid is considered cheaper than hydrocyanic-acid gas, less dangerous to use, more effective as an insecticide, and possessing a greater penetrating power when acting on like exposed areas. A small quantity of gas acting for a long time appears to have greater insecticidal value than a large quantity acting for a shorter period. It is believed that the gas will prove especially useful as an insecticide on shipboard.

Wilmon Newell gave the results of some observations upon a little-known insect enemy of cotton and corn (*Cicada nigriventris*). This insect did considerable injury to cotton on bottom lands in the Ouachita Valley during the past season. It is controlled by cultural methods.

A paper was presented by C. E. Sanborn on The Relation of Descriptions to Economical Methods of Eradication in the Family of Aphididæ, in which he called attention to the faulty descriptions of the different species of these insects.

A. W. Morrill presented Some Observations on the Spined Soldier Bug (*Podisus maculiventris*), in which descriptive notes were given and data as to variation in male and female, the number of eggs laid by the female, percentage which hatched, etc.

Entomological notes for the year from Texas were presented by A. F. Conradi; from Cuba, by M. T. Cook; from New York, by E. P. Felt; from Ohio, by A. F. Burgess; from New Hampshire, by E. D. Sanderson; from Georgia, by R. I. Smith and A. C. Lewis; from Maryland, by T. B. Symons; and from Minnesota, by F. L. Washburn.

Other papers presented before the society were as follows: The Problem of Wing Origin and Its Significance in Insect Phylogeny, by H. Osborn; Preliminary Observations on the Variation of *Utetheisa venusta*, by M. T. Cook; Observations upon the Migrating, Feeding, and Nesting of the Fall Webworm (*Hyphantria cunea*), by E. W. Berger; The Care of Entomological Types, by T. D. A. Cockerell; History of Economic Entomology in Hawaii, by J. Kotinsky; The More Important Economic Aleyrodidæ and The Life History and Habits of *Tisheria malifoliella*, by A. L. Quaintance; and Notes and Experiments with Insecticides, by E. P. Felt, S. A. Forbes, and A. F. Burgess.

A committee of five was appointed to confer with the Bureau of Entomology to devise a plan to bring about uniform rules for nursery inspection and to cooperate

with a similar committee from the Association of Horticultural Inspectors in devising a plan to secure authority for the inspection of all plants at the port of entry, to secure authority for the eradication and control of all species of insects which may enter, and to bring about a uniformity of regulations for nursery inspection either by Federal law or by uniform State laws.

A. H. Kirkland, of Massachusetts, was chosen president for the ensuing year, and A. F. Burgess, of Ohio, secretary-treasurer.

The American Forestry Association.—The American Forestry Association met in Washington, January 16, and held a two days' meeting, at which a number of interesting papers were read, officers elected, and considerable routine business performed. The president of the association, Secretary of Agriculture James Wilson, opened the meeting by a brief address, in which he called attention to the work of the association and of the forest service along forestry lines during the past year. Reforestation, in his judgment, should proceed at the rate of a million acres per year. To the forester every day of the year should be Arbor Day. The relation between the reclamation service and the forest service was pointed out. The reclamation service deals with the land below the ditch, while the forest service works above the ditch and seeks to preserve the waters for irrigation and manufacturing purposes.

Rev. Edward Everett Hale stated that in the matter of forestry the nation can do what the State or the individual can not do. The Government alone is in a position to make long-time investments, and should be the agent in establishing and maintaining forest reserves.

Mr. Bainbridge, representing the New York Manufacturing Association, spoke on the relation of forestry to the postal laws, in which he showed that 2,000,000 lbs. of second-class matter go through the post-offices in the United States every day in the year. About one-half of this material goes into the wastebasket. This means that 3,000,000 lbs. of forests go to waste each day. This kind of matter is allowed to go through the mail at 1 ct. per pound, while all other kinds cost 16 cts. per pound. It was believed that if these rates were adjusted more equitably less quantities of paper material would be wasted and our forests be protected to this extent.

Samuel B. Elliott called attention to the fact that the Canadian government last year gave away 7,000,000 forest trees to its people for planting purposes, and suggested that this Government might do something along a similar line.

A number of speakers discussed various phases of the Appalachian and White Mountain forest reserves. The association favored the combining of the four bills now before Congress relative to these reserves, and the supporting of one bill asking for $3,000,000 to purchase land for these reserves.

Several papers were read by representatives of the reclamation service in which the work of that service and various projects now under way were discussed. It appears that there are 13 projects now under construction and 10 more in view for the coming spring, at a total cost of $30,000,000. By 1908 it is expected that 1,250,000 acres of land will be under irrigation. This will accommodate about 20,000 families. Each community thus established will be directly interested in the preservation of water, and therefore in the maintenance of forests about the headwaters, since forests are essential to a continuous even flow throughout the year.

Secretary Wilson was reelected president for the ensuing year. A number of changes were made in the by-laws, by which the society will become more closely affiliated with the State forestry organizations and other societies interested in forestry matters.

Referees of Official Agricultural Chemists.—The referees appointed for this year are announced as follows: *Phosphoric acid,* B. W. Kilgore, Raleigh, N. C.; *determination of n trogen,* J. H. Gibboney, Blacksburg, Va.; *separation of nitrogenous bodies,* R. Harcourt, Guelph, Canada (milk and cheese proteids); *potash,* A. L. Knisely, Corvallis, Oreg.; *soils,* R. H. Loughridge, Berkeley, Cal.; *dairy products,* F. W. Woll,

Madison, Wis.; *foods and feeding stuffs*, J. K. Haywood, Washington, D. C.; *food adulteration*, A. E. Leach, Boston, Mass.; *sugar* (special analytical methods), C. A. Browne, jr., Audubon Park, New Orleans, La.; *tannin*, H. C. Reed, Stamford, Conn.; *insecticides*, G. E. Colby, Berkeley, Cal.; *inorganic plant constituents*, W. W. Skinner, Washington, D. C.; *medicinal plants and drugs*, L. F. Kebler, Washington, D. C.

The following are the associate referees: *Phosphoric acid*, J. M. McCandless, Atlanta, Ga.; *determination of nitrogen*, C. L. Penny, Newark, Del.; *separation of nitrogenous bodies*—meat proteids, F. C. Cook, Washington, D. C., and vegetable proteids, Harry Snyder, St. Paul, Minn.; *potash*, B. B. Ross, Auburn, Ala.; *soils*, J. H. Pettit, Urbana, Ill.; *dairy products*, J. M. Bartlett, Orono, Me.; *foods and feeding stuffs*, John P. Street, New Brunswick, N. J.; *food adulteration*—colors, E. F. Ladd, Agricultural College, N. Dak.; saccharine products, including confectionery, C. H. Jones, Burlington, Vt.; fruit products, H. C. Lythgoe, Boston, Mass.; wine, Julius Hortvet, St. Paul, Minn.; beer, H. E. Barnard, Indianapolis, Ind.; distilled liquors, C. A. Crampton, Washington, D. C.; vinegar, R. B. Fitz Randolph, Trenton, N. J.; flavoring extracts, E. M. Chace, Washington, D. C.; spices, A. L. Winton, New Haven, Conn.; baking powder and baking chemicals, W. M. Allen, Raleigh, N. C.; meat and fish, E. L. Redfern, Lincoln, Nebr.; fats and oils, L. M. Tolman, Washington, D. C.; dairy products, A. E. Leach, Boston Mass.; cereal products, A. McGill, Ottawa, Canada; infants' and invalids' foods, W. D. Bigelow, Washington, D. C.; vegetables, H. V. Tartar, Portland, Oreg.; condiments other than spices, R. E. Doolittle, New York; cocoa and cocoa products, E. M. Bailey, New Haven, Conn.; tea and coffee, C. D. Howard, Concord, N. H.; preservatives, W. L. Dubois, Washington, D. C.; and determination of water in foods, F. C. Weber, Washington, D. C.; *sugar*—molasses methods, J. E. Halligan, Baton Rouge, La., and chemical methods, L. S. Munson, Washington, D. C.; *tannin*, F. P. Veitch, Washington, D. C.; *insecticides*, W. B. Ellett, Blacksburg, Va.; *inorganic plant constituents*, John W. Ames, Wooster, Ohio; *medicinal plants and drugs*, Charles H. La Wall, Philadelphia, Pa.

Agricultural Education in France.—The French Ministry of Agriculture issued a decree December 20, 1905, establishing a professional dairy school at Surgeres (Charente-Inférieure), under the direction of M. Dornic, director of the dairy station at that place.

A winter school of agriculture has been established at Troyes (Aube). The course of study is to extend over 2 winter terms running from November to March. This year, however, the school did not open until January 3.

A poultry husbandry school has been established at Gambais (Seine-et-Oise), and opened its doors for the first practical course of 3 months February 1.

Agricultural Education in Germany.—The enrollment of students for 1905 in a number of German institutions shows a large increase over the enrollment for 1904. At the Agricultural High School in Berlin there are enrolled for the winter term 893, as compared with 865 in 1904; at the Agricultural Academy at Bonn 501, as compared with 422 in 1904, and at the University of Breslau the agricultural students number 140, as compared with 129 in 1904.

An agricultural winter school was opened December 1, 1905, at Seelow, under the direction of Dr. Weiss.

The Penn School.—This school for negroes, which was established in 1862, is located on St. Helena Island, off the coast of South Carolina. At a recent farmers' conference held under its auspices attention was called to the important progress made by the school in directing the farming and improving the agricultural conditions of the island and of adjacent territory in Beaufort County. P. W. Dawkins, a graduate of Hampton, is in charge of the agricultural work.

Agriculture in the Common Schools.—Nine hundred and two teachers in attendance at the Michigan State Teachers' Association, December 29, adopted the following res-

olution: This association heartily favors the incorporation of elementary agriculture in the common school curriculum as rapidly as possible and in so far as limiting conditions may permit. This association believes that this is an available means to the end of interesting the rising generation in the natural, mechanical, scientific, and social inheritance of the greatest industry; and that by this means an increasing number of the brightest children will come to see in agriculture an attractive field for the satisfaction of life's ambitions. The possibilities of agriculture as an industry from which the educational process itself may be enriched are also recognized.

Elementary Agriculture in the Common Schools of Ohio.—Prof. A. B. Graham, of Ohio State University, states in the January number of the Agricultural Student that over 250 townships have already adopted elementary agriculture as a part of their course of study, and that about 10 high schools have taken similar action. The State commissioner of schools has considered this work of sufficient importance to give credits for agriculture in his grading of the high schools.

Boys' Corn-Growing Contest.—More than 100 boys have entered a corn-growing contest to be conducted in 1906 in Laporte County, Ind., under the auspices of the County Farmers' Institute Association. As a preliminary to this contest the contestants attended the local farmers' institute February 2 and 3, at which a corn school was conducted. Each boy will grow 1 acre of corn, and the contest will be closed with the awarding of prizes aggregating $300 in value.

Reading University College Poultry Farm.—A description of the poultry farm at Theale, carried on in conjunction with the University College of Reading, England, is given in the December number of the Agricultural Economist. The farm consists of nearly 50 acres of land and is provided with an excellent equipment, which is assembled in an incubator house, a brooder house, scratching sheds, a cramming shed, portable poultry houses, and a plucking and trussing shed. Six breeds of chickens and 1 of ducks are raised.

Publication of Names of Dealers in Adulterated Seeds.—The Attorney-General has decided that the Secretary of Agriculture has the right to publish the names of seedsmen who adulterate their product, and that such publication does not render him liable for criminal libel. The Department has been publishing such information, and the law providing for the seed inspection makes the publication mandatory.

A New Food Journal.—The first number of a new monthly publication, entitled *The American Food Journal*, has just been published in Chicago. This has for its object the dissemination of information regarding the State pure-food laws, investigations which have a bearing on the effects of preservatives, coloring matters and similar topics, and in general the publication of data which will serve to further the interests of officials in charge of the enforcement of pure-food laws, manufacturers who are desirous of producing high-grade goods in compliance with legal requirements, and dealers who handle food products. A feature of the journal, it is stated editorially, will be the collection of data regarding Federal and State pure-food laws, the publication of reports of conventions of pure-food chemists, and related material.

New Poultry Journal.—A new poultry journal, entitled *Poultry Husbandry*, began publication in January. The journal is to be a monthly and is published at Waterville, N. Y. Among its contributors are several men now or formerly connected with the experiment stations.

Miscellaneous.—Prof. Samuel Fraser, of Cornell University and Station, has decided not to accept the appointment in the Bureau of Soils, mentioned in the last issue. He will take up the management of W. A. Wadsworth's estate, at Geneseo, N. Y., to carry out some improvements outlined by him in a report to Mr. Wadsworth last summer, as the result of a thorough agricultural survey of the estate and the system of management followed.

Dr. W. Krüger, vice-director of the agricultural chemical experiment station at Halle and chief of the bacteriological section, has been appointed director of the

Bernburg Station, made famous by the work of Hellriegel and Wilfarth on nitrogen assimilation by legumes. He has also been given the title of professor.

It is noted from *Science* that Dr. Pehr Olsson-Seffer, for the past two years instructor in botany in Stanford University, has been selected to take charge of a botanical station in tropical Mexico for the investigation of problems connected with the cultivation of rubber and coffee. The station is established by companies which own twelve large plantations in the region where it is to be located, devoted to the raising of rubber and coffee.

The Carnegie Institution has established a department of botanical research, to include the Desert Laboratory and other botanical projects. Dr. D. T. MacDougal, assistant director of the New York Botanical Gardens, has become director of the newly organized department.

The North Carolina Agricultural and Mechanical College for the Colored Race has recently completed a new laboratory for soil physics, which is well provided with apparatus for determining specific gravity, apparent specific gravity, volume weight, porosity, and other characteristics of soils.

The market-day lectures, delivered under the auspices of the County Technical Laboratories at Chelmsford during 1904–5, reference to which has previously been made, have been published in abstract by the Essex Education Committee.

Studley College Agricultural Journal is the title of a new journal issued by Lady Warwick's agricultural college. In the first number J. C. Medd points out a new opening for students of that college and the college at Swanley as teachers of nature study in village schools. Several counties are said to be appointing peripatetic teachers of nature study to attend to groups of adjacent schools, and it is predicted that with a sufficient supply of efficient teachers, demand for their services will steadily increase.

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EXPERIMENT STATION RECORD.

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The efforts which are making for the promotion of agriculture in India are described in the initial number of *The Agricultural Journal of India*, which has recently come to hand. The leading article in this new journal is by the inspector general of agriculture in India, and reviews the history of the movement to improve the condition of agriculture in that country, the present status of this work, and the plans for future development. It is a decidedly interesting and instructive article, and shows that the government of that country is thoroughly aroused to the desirability and importance of aiding its basic industry by means of research, education of different grades, demonstration, and close contact with the farmers.

The machinery for conducting this work already exists, and hence it becomes largely a matter of extending these agencies and increasing their efficiency. The organization for agriculture includes an imperial department of agriculture, with headquarters at Calcutta, and a system of provincial departments of agriculture, each presided over by a director, and to a certain extent independent of the imperial department. This system has grown out of the inquiries and recommendations made by the famine commissions of 1866 and 1880, and in organization has naturally followed the main division of the general administration into imperial and provincial departments.

The imperial department is presided over by the inspector-general of agriculture and the assistant inspector-general. The staff includes the director and principal of the agricultural research institute and agricultural college at Pusa, and several specialists, among them an agricultural chemist, a cryptogamic botanist, a biological and economic botanist, an entomologist, an "agri-horticulturist," and an "agri-bacteriologist." There are eight provincial departments of agriculture located, respectively, in the provinces of Bombay, Madras, Bengal, United Provinces of Agra and Oudh, Punjab, Central Provinces, Assam, and Burma. Each department has a director and a deputy director, frequently an assistant director, and an irregular number of specialists. In several cases inspectors and botanists are carried upon the staff, and the Bengal department has indigo and jute specialists, while the Bombay department has an agricultural chemist.

The duties of the provincial departments include the keeping of land records, which requires the collection and examination of agricultural statistics for each village and district, as a basis for the assessment and collection of revenues levied upon land. These departments also have important duties in connection with the famine relief, including furnishing the administration with the fullest information regarding the condition of every agricultural section and its people, and in seasons of scarcity they carry their inquiries to every village and assist in the actual work of relief.

The provincial departments of agriculture also include a veterinary branch, which consists of one or more qualified officers with European degrees in veterinary science, and a large native staff of veterinary inspectors and assistants. The principal duties are the investigation, control, and treatment of cattle diseases, and the improvement of the breeds of cattle. There are numerous veterinary dispensaries in the towns, and much work is done in the villages. There are also veterinary colleges at Lahore, Bombay, Madras, and Calcutta, and schools in some other provinces.

Although this provincial veterinary work is under the control of the local directors of agriculture, the imperial branch of the civil veterinary department is separate from the department of agriculture, being managed by an inspector-general. Similarly, the great irrigation works of the government, which are on the largest scale to be found in any country, are managed independently of the imperial department of agriculture, being a branch of the public works department; and the forestry interests are in charge of the forest department. There are also imperial and provincial departments of meteorology, which maintain weather stations for record and prediction, and a botanical survey of India has been in progress for many years. So that all told the field is quite fully covered in organization.

In recent years both the imperial and provincial departments have made rapid progress in the direction of the improvement of agriculture by means of investigations and experiment. In 1903 the government of India sanctioned the establishment of an imperial agricultural research station, which is located at Pusa in Behar, the most thickly populated agricultural tract of the Bengal Presidency. The station has fully equipped laboratories for research work, and stands at the head of the India system of experiment stations and farms. With it is connected a higher agricultural college, an experimental farm, and a cattle breeding farm. The institute is located on a government estate of 1,358 acres, and the buildings now in progress will cost considerably over a half-million dollars, toward which has been applied a portion of the donation of $150,000 made by Mr. Henry Phipps, of this country, to which reference has previously been made. The organization of this staff, composed of European specialists with native assistants, has now been completed.

The college will be the capstone of the system of agricultural education in India. It will provide specialized post-graduate courses in the hope that the best of the native students will ultimately be fitted for the higher appointments in the imperial department. It will also provide men with a good agricultural education for employment in the regular government service, and as agents and managers for owners of estates and the like. It is expected that the college will be ready to start work about the end of 1907.

The farm will provide facilities for field experimentation and for the practical training of students, and it is hoped that it will serve as a model for similar farms under the provincial governments. The cattle farm is intended to furnish good bulls for distribution to the adjoining tracts of Bengal, for the improvement of the indigenous breed of cattle.

It is also the intention that the expert staff of the Pusa institute shall conduct higher lines of research work applicable to all parts of India, and beyond the capacity of the provincial departments. Moreover, this staff will render assistance to the provincial experts in their several branches, train young scientists for future employment as provincial experts, and stand at the head of their respective departments in the agricultural college.

The system of experiment stations and farms in India includes, in addition to the research institute at Pusa, thirty-nine establishments in seven different provinces. These are of different grades, some being general experiment stations, others devoted mainly to a particular line, like cotton, tobacco, rice, sugar, fibers, or tropical fruits, and others to sewage farming, irrigation work, alkali reclamation, cattle breeding, and sericulture. There are eleven of these stations in Bombay, seven in Madras, nine in Bengal, five in the United Provinces of Agra and Oudh, two in Punjab, three in the Central Provinces, and two in Assam.

The institutions for agricultural education include, besides the agricultural college at Pusa, a college of agriculture at Saidapet, Madras, with farm attached, a college of science at Poona, and agricultural schools at Sibpur (Calcutta), Cawnpur, and Nagpur.

In pursuance of the policy inaugurated by the establishment of the Pusa institute and agricultural college, it is planned to greatly extend the work of the other agricultural colleges and experiment stations, and of the provincial departments of agriculture. To this end an additional grant of about $660,000 has been made, which it is hoped to increase in future years. This grant will almost treble the present expenditure. The plans for development include an experimental farm or station for each important distinct agricultural tract. This

will mean a very large increase in these farms, each of which will be in charge of a trained native assistant, with the necessary helpers.

It is proposed to strengthen the expert staff of each provincial department of agriculture so as to include one or more superintendents of farms, an agricultural chemist, economic botanist, mycologist, and entomologist. The superintendent of farms in each province, or deputy director, will be an expert agriculturist and will be in charge of a "circle," which in the case of large provinces will comprise only a part of a province. In his circle he will supervise all agricultural work, including the experiment stations, demonstration plats, the testing and distribution of seeds, implements, and special manures. He will also be in close touch with the cultivators, and will be the guiding spirit of the agricultural associations of his circle. He will be assisted by the workers at the experimental farms and a peripatetic staff. The specialists at the provincial experiment station will not only conduct investigations in their laboratories and on their farms, but will tour throughout the province, visiting all the local experiment stations and farms, directing the work connected with their special branches, and inquiring into local conditions.

It is further proposed to locate an agricultural college in each important province, with a course of technical training extending over three years. In the past the personnel of the agricultural colleges has been inadequate, so that their influence on agricultural improvement has been small. The main result of the colleges has been to turn out students with some knowledge of agriculture, who have been largely absorbed into the several branches of government revenue administration. It is believed now that the demand for graduates will be sufficient to induce a larger number of students to attend, as the field for the trained agriculturist is said to be broadening. The course in the provincial agricultural colleges will lead up to the specialized post-graduate course at Pusa.

Considerable attention will also be given to the dissemination of information, especially the results of agricultural investigation and their application in practice. Temporary demonstration plats will be started, district agricultural associations will be organized, agricultural shows will be subsidized, the distribution of improved seed, implements, and manures will be extended, and popular publications in the vernacular will be issued. It is pointed out that there are many difficulties in the way of agricultural improvement in a country like India, where most of the land is divided into small holdings and cultivated by men with no capital and little education; but by the means enumerated it is hoped to bring the work into closer touch with the actual farmers, and make it of more immediate use to them.

As a further concentration of effort it is proposed to separate the land records branch of the provincial departments, and to appoint a

separate director of agriculture, who will be in charge of the agricultural and veterinary branches, thus relieving the departments of a line of work which has made serious demands upon them in the past. In the imperial department of agriculture it is proposed to increase the number of specialists for the investigation of important special crops or problems, as cotton, wheat, sugar, tobacco, fruit, etc. This will enable coordinating the work in different provinces, assisting the provincial experts in various ways, conducting experiments in the improvement of varieties by selection and breeding, and promoting special agricultural industries.

Several years will be required to introduce this scheme for the expansion of the imperial and provincial departments of agriculture in its entirety, but the condition of the finances of the country is said to be such as to warrant the development of this important work. That its value is now being appreciated is indicated by the statement that "one of India's shrewdest merchant princes has described expenditure upon scientific agriculture as the most promising investment that government can make."

As one means of extending the influence of the imperial and provincial departments of agriculture, the government of India has sanctioned the publication of *The Agricultural Journal of India*, which will be issued from the agricultural research institute at Pusa. The journal will be a quarterly and will be devoted to matters of interest to the general reader, while more strictly scientific and technical papers will be published in a second series entitled *Memoirs of the Department of Agriculture in India*. The inspector-general of agriculture will act as editor, assisted by the advisory committee of the Pusa staff.

While the new journal and the memoirs will thus be the official organs of the imperial department, they will not be confined to articles contributed by their workers. The work of the provincial departments has often been buried in annual reports and other official publications, which have rarely been readily available to the public and not always in a form for general use.

The new journal will form a permanent record of the practical results of agricultural research throughout India. It will also serve as a medium of communication between the officers of the several departments, thus relieving in some measure the isolation which exists at present. It is hoped by the administration that the journal will appeal to the outside public and the leading agriculturists in India, who will thus be kept in touch with agricultural progress in the country and will be able to test and practice more advanced methods and the application of science to agricultural problems. The initial number is interesting and attractive, and augurs well for the success of the venture from the editorial standpoint.

NEW HORTICULTURAL BUILDING AT THE MASSACHUSETTS AGRICULTURAL COLLEGE

Wilder Hall, the new building for the department of horticulture and landscape gardening at the Massachusetts Agricultural College, was erected with an appropriation of $39,950 made by the State legislature a year ago. The proposition to provide such a building at the college had been pending for nearly three years at the time the appropriation became available, and during that time all the questions connected with the building had been thoroughly studied from various points of view, and the plans had been more than usually well matured. This long period of preparation, therefore, resulted in securing a building more perfect in its appointments than could otherwise have been devised. It was built by local contractors, who began work upon it June 21, 1905.

The building is located on a gravelly slope to the east of the college campus and adjoining the grounds of the department of horticulture. The natural incline of the land is such as to allow a basement almost entirely above ground on the west, making the building on that side apparently one story higher than on the east. Advantage has been taken of this in the arrangement of the rooms of the building, as will be seen by the accompanying plate. (Plate I.)

The building is constructed of red brick with terra-cotta trimmings, and modern fireproof methods and materials have been used throughout. The nonbearing partitions are of fireproof tile, the bearing partitions of brick, and the floors of hollow fireproof tile. The staircases are of Portland cement on hollow fireproof tile, and many of the floors are finished in Portland cement. The roof is of green tile on wooden trusses, the latter being the only exception to the fireproof construction. The building is thoroughly constructed, and is very substantial in all respects. It is devoted entirely to the department of horticulture and landscape gardening, and has a total floor space of nearly 10,000 square feet, a very large proportion of which is available for use.

The basement floor (fig. 2) contains two class rooms, a storage room, and two laboratories, besides hallways and toilet rooms, a coat room,

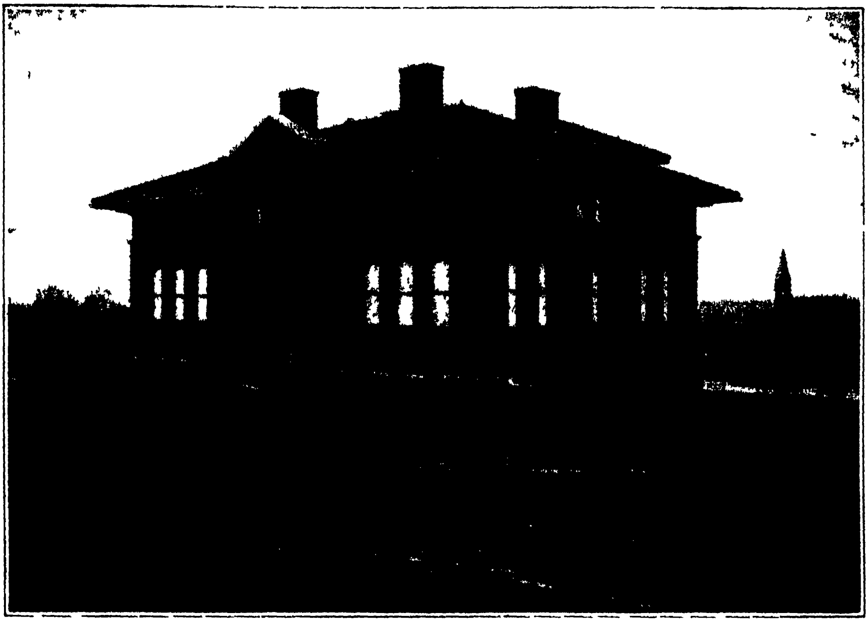

FIG 1.—WILDER HALL—EAST FRONT.

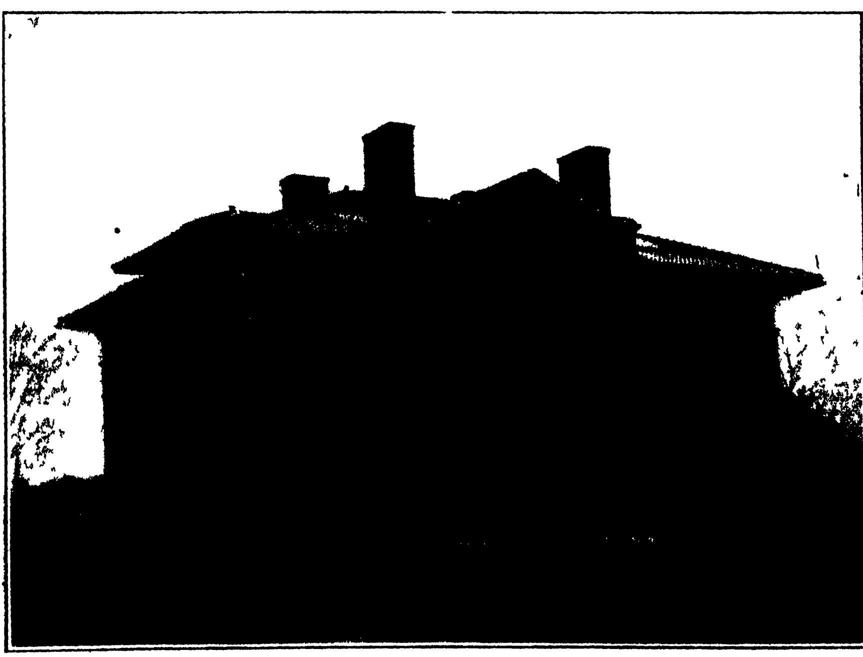

FIG 2.—WILDER HALL—WEST FRONT.

and a room for surveying instruments. The entrance to the basement is on the western front and is on a level with the ground. This front is toward the college campus and is the natural entrance for students. As the class rooms and laboratories for the larger classes are located on this floor, the movement of large bodies of students up and down stairs and through the hallways is avoided and there is no disturbance of work which may be in progress on the other two floors of the building. Only small classes of advanced students are provided for on the upper floors.

The first, or middle, floor (fig. 3) opens on the ground level on the east side of the building. This is the side on which the grounds of the department of horticulture are located, and the principal office looks directly out upon the grounds. Between the offices of the head

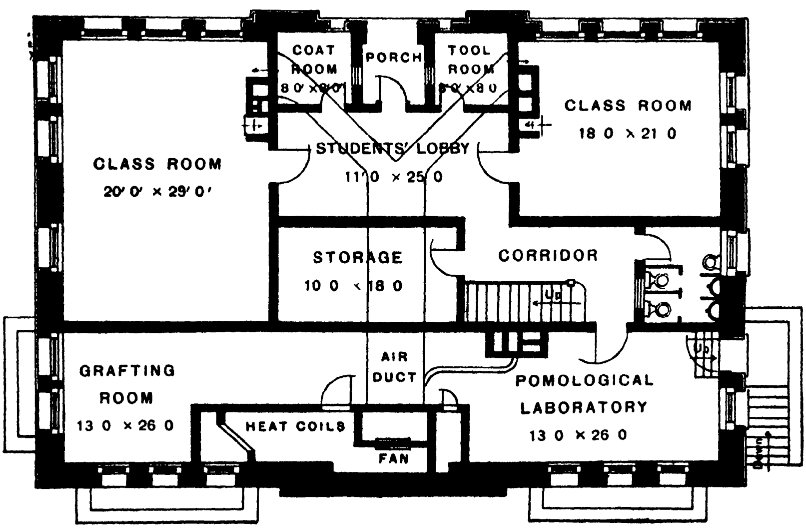

FIG 2.—Basement plan

of the department and the assistants is a small room for records, experimental files, etc. At the other end of the floor are a museum, and a laboratory for senior students in horticulture, with a reading room adjoining in which horticultural periodicals and reference books will be kept. This suite will constitute a sort of club room for the advanced students and form a meeting place for seminars. Provision is made in the center of the western side for a winter conservatory.

The upper floor (fig. 4) contains a large drafting room for landscape gardening, as the work in this course is largely done on drafting tables. There is also a large class room fitted with drawing tables, photographic rooms, a private laboratory, and quarters for a janitor. This floor is well lighted, there being four large skylights in addition to the windows.

The building will be equipped with the most modern furniture and apparatus. It is heated from the central heating plant of the college,

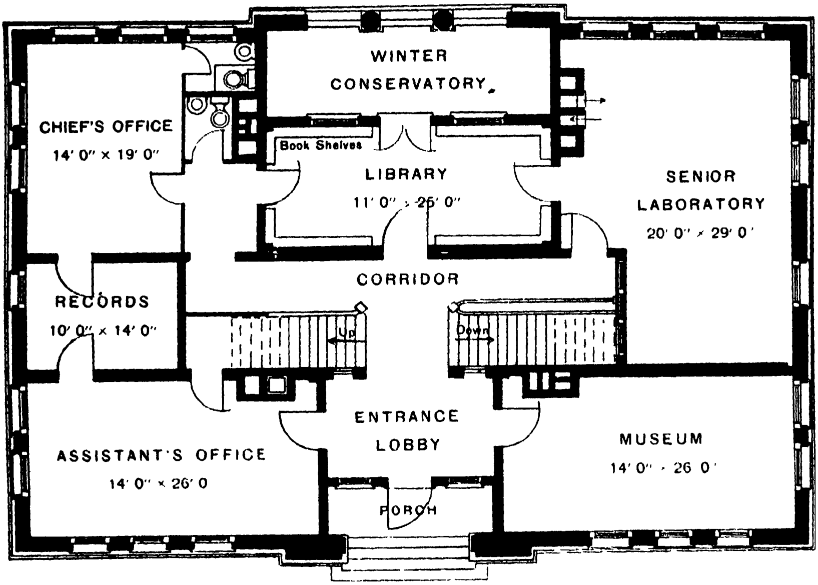

FIG. 3.—First-floor plan.

and a very complete system of positive ventilation has been installed. The building is named in memory of Hon. Marshall Pinckney Wilder,

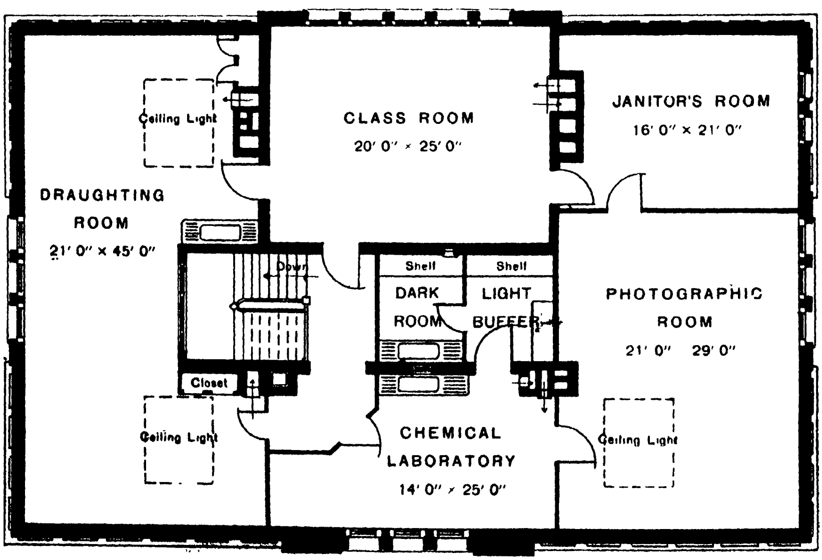

FIG. 4.—Second-floor plan.

of Massachusetts, widely known for his services to horticulture, and for twenty-three years a trustee of the college.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Agricultural chemistry during the first half of the year 1905, W. ZIELSTORFF (*Chem. Ztschr., 4 (1905), Nos. 21, pp. 491–495; 22, pp. 505–507*).—This article notes especially the work of König, showing the importance of physical factors in soil fertility; of Lemmermann on the relation of volume of soil to plant growth; of Ewert on the influence of light and copper-lime solutions on metabolism in plants; of Sjollema on the isolation of the colloid substances of soils and the use of coloring matters in soil investigations; of von Seelhorst on the influence of soil moisture on the growth of oats; of Loew et al. on the lime requirements of plants; of Meyer on the injurious effect of gypsum on plants grown in zinc pots; of Weitz on the use of nitrate of soda as a fertilizer; of Frank, Rösler, Löhnis, and Tacke on the use of lime nitrogen as a fertilizer; and of von Lepel on the preparation of nitrites and nitrates by electrical discharges and on the use of the product as a fertilizer.

A number of minor articles are also referred to on experiments with fertilizers of various kinds, including lime, marl, magnesia, steamed Thomas slag, Peruvian guano, ammoniated superphosphate, Thomas-ammonium-phosphate lime, etc. Recent investigations relating to animal nutrition are also reviewed Most of the articles mentioned have been noted from time to time in this journal.

Formation of oceanic salt deposits. XLIII, Calcium content of the constant solutions at 25°, J. H. VAN'T HOFF and W. C. BLASDALE (*Sitzber. K. Preuss. Akad. Wiss., 1905, No. 34, pp. 712–714; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 516, II, p. 641*).—"This paper concludes the investigation in so far as calcium compounds at 25° are concerned, and the composition of all constant solutions, when saturated with the particular calcium salt with which the solutions are in equilibrium, is tabulated. For the sake of simplicity, gypsum, glauberite, and syngenite are the only salts taken into consideration, but the quantities of calcium found in the solutions can not, however, on this account differ appreciably from the true equilibrium values."

Comparative study of methods of analysis of fertilizers in different countries, L. SICARD (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1905), No. 2, pp. 111–147*).—This is the second part of a report on this subject dealing with methods of determining phosphoric acid.

A method for the determination of black alkali in irrigating waters and soil extracts, W. W. SKINNER (*Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 77–80*).—The method described for this purpose is a modification and adaptation of the method proposed by Hehner as a substitute for the Clark process for determining hardness of waters.

Two hundred cc. of the water or soil solution is evaporated to dryness in a platinum or silver dish, with 50 to 150 cc. of fiftieth-normal sodium carbonate solution. The residue is rubbed up with distilled water free from carbon dioxid, the volume being made up to 100 cc. Fifty cc. of this solution, which has been allowed to stand until it is clear, is titrated with fiftieth-normal sulphuric acid, adding 5 cc. of chloroform and 1 cc. erythrosin as indicator.

"If less sulphuric acid is required than that necessary to balance one-half of the sodium carbonate added . . . the difference in cubic centimeters between the sulphuric acid required and one-half of the sodium carbonate added is multiplied by the factor 0.00136, which gives the equivalent of calcium sulphate in 100 cc. of the water. But if, on the other hand, more sulphuric acid is required than that equivalent to one-half of the sodium carbonate added, then black alkali was originally present in the solution, and the difference in cubic centimeters is multiplied by the factor 0.00106, which gives the black alkali in terms of sodium carbonate in 100 cc. of water. . . .

"While not strictly correct, custom and practical considerations sanction the expression of black alkali in terms of sodium carbonate. The method described yields satisfactory results for black alkali and also for the antidote for black alkali—i. e., soluble salts of calcium and magnesium, which for irrigation purposes should be expressed in terms of calcium sulphate."

Determination of the strength of solutions used in nitrogen determination, F. MACH (*Landw. Vers. Stat., 63 (1905), No. 1–2, pp. 71–80*).—Comparative tests of potassium tetroxalate, sodium hydroxid, and ammonium sulphate are reported which show that potassium tetroxalate and ammonium sulphate tend to give results somewhat over the average, sodium hydroxid somewhat below.

The determination of the organic nitrogen in sewage by the Kjeldahl process, E. B. PHELPS (*Jour. Infect. Diseases, 1905, Sup. 1, May, pp. 255–272*).—Experiments are reported which indicate that a strong oxidizing agent, such as potassium permanganate, potassium bichromate, or aqua regia, added before digestion is completed causes a decided loss of nitrogen, but may be safely added after the digestion is completed. The substitution of copper sulphate for mercury is proposed, as it obviates the necessity for the subsequent addition of sodium sulphate. The method proposed is in brief as follows:

Digest 100 cc. of the sewage with 5 cc. of sulphuric acid and 0.1 gm. copper sulphate until the yellow color has entirely disappeared; add small crystals of potassium permanganate, one at a time, until the green color of the precipitate is permanent; cool the contents of the flask, and make up to 500 cc. with ammonia-free water. To 10 cc. or more of the solution, according to the nitrogen content, add an equal amount of ammonia-free water, make strongly alkaline with a saturated solution of sodium carbonate equal to half the amount of the acid mixture, and distill over 50 cc. by blowing steam through the solution. Determine ammonia in the distillate in the usual manner by nesslerization.

On the determination of nitric and nitrous acids, J. MEISENHEIMER and F. HEIM (*Ber. Deut. Chem. Gesell., 38 (1905), No. 15, pp. 3834–3837, fig. 1*).—The authors describe a method suggested by Kalman, which is based upon the measurement of the nitric oxid (NO) set free when nitrous acid is treated with hydrogen iodid and when nitric acid is treated with ferrous chlorid and hydrochloric acid in the usual way. In mixtures of the two the nitrous acid is decomposed first by the addition of the hydrogen iodid, and the nitric acid remaining in the solution is subsequently decomposed by addition of ferrous chlorid and hydrochloric acid, the operation being carried on in an atmosphere of carbon dioxid, and the nitric oxid evolved in each stage being measured. A number of tests of the method are reported which show close agreement between the calculated percentages and those found by analysis.

The determination of nitrous acid, F. RASCHIG (*Ber. Deut. Chem. Gesell., 38 (1905), No. 16, pp. 3911–3914*).—It is pointed out that the method described by Meisenheimer and Heim (see above) is the same in principle as that which has long been used by the author except that instead of measuring the nitric oxid the author titrates, after the lapse of at least 2 minutes, the separated iodin, the latter procedure being much quicker than the former.

On the determination of nitric and nitrous acids, J. MEISENHEIMER and F. HEIM (*Ber. Deut. Chem. Gesell., 38 (1905), No. 17, p. 4136*).—A reply to the above statement of Raschig that the principle of the method proposed by the authors is not new, in which it is maintained that the only original feature claimed for the method is the determination of nitric and nitrous acids in the same solution.

Change in the German official method of estimating nitric acid in meat and meat products, K. FARNSTEINER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 6, pp. 329, 330*).—The author concludes that the Schlösing-Wagner method should be used in the estimation of nitrites in meat and meat products.

The quantitative estimation of nitric acid in meat, W. STÜBER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 6, pp. 330–335, fig. 1*).—Comparative tests showed, in the author's opinion, that the Schlösing-Wagner method for estimating nitrites in meat gave satisfactory results even for the determination of very small amounts and that the presence of organic nitrogenous bodies did not exercise any unfavorable effect.

Judging meat extracts on the basis of the organic phosphorus present, M. SIEGFRIED and E. SINGEWALD (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, pp. 521–527*).—On the basis of analytical data which are reported the authors conclude that the quality of meat extract may be judged by estimating the total phosphorus and organic phosphorus present, since it has been found that when the extract spoils organic phosphorus is converted into inorganic forms.

A study of the proteins of the castor bean, with special reference to the isolation of ricin, T. B. OSBORNE, L. B. MENDEL, and I. F. HARRIS (*Amer. Jour. Physiol., 14 (1905), No. 3, pp. 259–286*).—The chemical study of the castor bean, which is reported, indicates, in the authors' opinion, that it contains proteins of the same character as the other oil seeds which have been examined, namely, (1) a considerable quantity of a crystallizable globulin, (2) a much smaller amount of a coagulable albumin, and (3) proteoses. The elementary composition and reactions of these substances were studied.

"The physiological properties—marked toxicity and agglutination of blood corpuscles—ascribed to the substance known as ricin are associated with the coagulable albumin of the castor bean. This protein was isolated in a state of considerable purity without impairment of its solubility or physiological action, and an improved method for the separation of ricin is thus introduced.

"Our ricin preparations retain a considerably higher toxic power than those heretofore described, a limit of 0.001 mg. per kilo being exceeded as a fatal dose in rabbits."

Studies of the nature of strawberry fat, J. APARIN (*Zhur. Russ. Fiz. Khim. Obshch., 36 (1904), pp. 581–596; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, pp. 562, 563*).—Wood strawberries (*Fragaria vesca*) were dried and the fat extracted.

A thick oil was obtained, cloudy at ordinary temperature but clear when heated somewhat. A characteristic strawberry-like odor, probably due to the presence of an ethereal oil, was noticeable but not prominent. The strawberry oil was found to be a drying oil, and in this and other respects much resembled linseed oil. Linoleic acid constituted 81 per cent of the total acid present and linolenic acid 10.5 per cent. Only traces of oleic acid were noted.

The behavior of lecithin to ferments, P. MAYER (*Berlin. Klin. Wchnschr., 42 (1905), p. 1102; abs. in Zentbl. Physiol., 19 (1905), No. 17, p. 601*).—According to the author the lipase of intestinal juice induces asymmetric cleavage of lecithin. The modification which turns the plane of polarized light to the right is broken down in the cleavage process, while a form hitherto unknown, which rotates the plane of polarized light to the left, remains.

The curcuma reaction for boric acid, A. Goske (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 4, pp. 242, 243*).—A modification is proposed of the German official method for detecting boric acid with curcuma paper, which the author claims is delicate enough to reveal the presence of 0.001 to 0.0001 per cent.

A long, narrow strip of the paper is allowed to dip into the solution to be tested. Owing to capillary attraction the liquid rises in the paper to a greater or less height, and on the upper edge of the wet portion the red-brown color will be distinctly noticeable if boric acid is present. Soda solution turns this red-brown zone blue. This method reveals the presence of a minute amount of boric acid in many sorts of common salt, therefore it is pointed out that the character of the salt must be known in testing for boric acid in ham, bacon, etc.

The qualitative detection of boric acid, O. Mezger (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 4, pp. 243–245*).—A modification of the German official method for detecting boric acid with a hydrogen flame is proposed.

After incinerating a suitable sample (15 or 20 gm.) previously moistened with sodium-carbonate solution, a portion of the ash is tested with curcuma paper and the remainder placed in a flask with 15 to 20 cc. of methyl alcohol, the flask being fitted with a reverse condénser. Two cc. of concentrated sulphuric acid is added and the mixture warmed on a water bath at 70° for a quarter of an hour. Hydrogen gas passed through the mixture after cooling will give the characteristic green flame if borax is present.

Quantitative estimation of vanillin, J. Hanuš (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 10, pp. 585–591*).—According to the analytical data reported, nitrobenzhydrazin is the most satisfactory reagent for the quantitative estimation of vanillin in vanilla, vanilla commercial products, and extracts.

Paints and paint products, E. F. Ladd and C. D. Holley (*North Dakota Sta. Bul. 67, pp. 575–604*).—This bulletin contains information on paints and paint products, especially as regards the character of various products entering into the preparation of paints, and is occasioned by the recent State law taking effect January 1, 1906, and which was enacted for the purpose of preventing adulteration and deception in the sale of paints, which it is the duty of the director of the station and his assistants to enforce. The present bulletin deals only with white paints, while future bulletins will treat of other paints and also oils, oil substitutes, and driers. Analyses of 28 samples of paint are reported.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 33 (1905), Nos. 6, pp. 233–286, figs. 12, charts 9; 7, pp. 287–348, pls. 4, figs. 7, charts 9; 8, pp. 349–384, fig. 1, charts 9; 9, pp. 385–432, figs. 8, charts 9*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of June, July, August, and September, 1905, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 6.—Special contributions on Tornado of June 5, 1905, at Binghamton, N. Y. (illus.), by W. E. Donaldson; A Novel Type of Record Sheet Adapted to Seismographs, Aerial Meteorographs, etc., by C. F. Marvin; Observations of Atmospheric Electricity After the Eruption of Mount Pelée, May 8, 1902 (illus.), by A. W. Wright; Improved Methods for Finding Altitude and Azimuth, Geographical Position, and the Variation of the Compass (illus.); and Annual Rings of Tree Growth, by E. E. Bogue (see p. 669); and notes on the scientific staff of the Weather Bureau, inventions patented by Government employees, seismology in the United States, the Libbey circle in seismology, the Piche evaporometer (illus.), the associations of

teachers of physics and mathematics, Weather Bureau men as educators, the new edition of Hann's Meteorology, contributions to the physics of the free atmosphere, hailstorm in the Bahamas, no change of climate, explorations of the upper atmosphere by the Blue Hill Observatory, an old reference to the kite in meteorology, winds and waves, diurnal variation of atmospheric humidity, and the guango, or rain tree.

No. 7.—Special contributions on Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—V, The Variable Action of the Sun and Its Effect upon Terrestrial Weather Conditions (illus.), by F. H. Bigelow; The Meteorological Work of the U. S. Naval Eclipse Expedition to Spain and Algeria, August 30, 1905, by F. H. Bigelow; Observations of Earth Temperature in Japan (illus.), by S. T. Tamura; An Account of Recent Meteorological and Geophysical Researches in Japan, by S. T. Tamura; The Variation in Minimum Temperatures on Still, Clear Nights Within the Confines of a Village (illus.), by W. I. Milham; Earthquakes Recently Recorded at the Weather Bureau, by C. F. Marvin; Tides and Thunderstorms, by J. C. Beans; Has the Rainfall of Southern California been Affected by any So-called Rainmaker? and Meteorological Records at Orono, Me., by J. S. Stevens; and notes on the pioneer forecasters of hurricanes, simultaneous weather anomalies in Iceland and Europe, the sugar beet and its climatic environment, Weather Bureau work during the eclipse of August 30, 1905, meteorology in Petermann's Geographische Mitteilungen, showers of fish, Hawaiian climatology, scientific aeronautics, mirage after sunset, a quadruple rainbow, meteor in Montana, reorganization of meteorology in Australia, the station at Port au Prince, Haiti, a severe hailstorm at Grand Rapids, Mich., meteorological course at Williams College, and a caution as to hypotheses.

No. 8.—Special contributions on The Tornado of May 10, 1905, at Snyder, Okla., by C. M. Strong; and Studies on the Diurnal Periods in the Lower Strata of the Atmosphere—VI, General Review of the Status of Cosmical Meteorology, by F. H. Bigelow; and notes on kite work in the Atlantic trade-wind region, and the impartial distribution of weather-crop bulletins.

No. 9.—Special contributions on The Lifting Power of Ascending Currents of Air, by H. H. Clayton; The West Indian Hurricane of August 11, 1903 (illus.), by M. Hall; and Japanese Meteorological Service in Korea and Manchuria (illus.), by Y. Wada, trans. by S. T. Tamura; and notes on Dr. Julian Aparicio, Pietro Tacchini, Robert August Billwiller, tornado at Carbondale, Pa., August 30, 1905 (illus.), Mohn's results of Nansen's North Polar work, meteorology in South America, E. D. Archibald and the modern kite, the Mount Weather observatory, importance of research observatories for the promotion of meteorology, mountain stations and their importance, an absurd explanation as to Indian summer, the altitude of Mount Whitney, Cal., new Canadian provinces (illus.), the green ray at sunset, and ball lightning.

Meteorological observations, J. E. Ostrander and C. H. Chadwick (*Massachusetts Sta. Met. Buls. 203, 204, pp. 4 each*).—Summaries of observations on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1905. The general character of the weather of each month is briefly discussed, and the December bulletin gives a summary for the year. The principal data in this summary are as follows:

Pressure[a] (inches).—Maximum, 30.86, December 1; minimum, 29.22, April 6; mean, 30.019. *Air temperature*[b] (degrees F.).—Maximum, 93, July 10; minimum, −13, January 24; mean, 45.8; mean sensible (wet bulb), 41.1; maximum daily range, 45, June 9; minimum daily range, 3, June 12; mean daily range, 22.1. *Humidity.*—Mean dewpoint, 37.3; mean relative humidity, 76.5. *Precipitation.*—Total rainfall or melted snow, 38.8 in.; number of days on which 0.01 in. or more rain or melted snow fell, 122; total snowfall, 40 in. *Weather.*—Total cloudiness recorded by sun thermometer, 1,977 hours, or 44 per cent; number of clear days, 130; number of fair

[a] Reduced to freezing and sea level. [b] In ground shelter.

days, 128; number of cloudy days, 107. *Bright sunshine.*—Number of hours recorded, 2,477, or 56 per cent. *Wind.*—Prevailing direction, west; total movement 46,442 miles; maximum daily movement, 475 miles, January 4; minimum daily movement, 1 mile, June 22; mean daily movement, 127 miles; maximum pressure per square foot, 23.5 lbs., January 4, WNW. *Dates of frost.*—Last, May 24; first, September 15. *Dates of snow.*—Last, May 1; first, November 9.

Meteorological summary for 1904, C. A. PATTON (*Ohio Sta. Bul. 163, pp. 259–272*).—This summary includes notes on the weather and tabulated daily and monthly records of observations at the station at Wooster, Ohio, on temperature, precipitation, cloudiness, direction of the wind, etc., and for comparison, similar data for previous years and for other parts of the State. The following is a summary of results:

Summary of meteorological observations in Ohio.

	For the experiment station.			
	1904.		1888–1904.	
Temperature (° F.):				
Mean		47.1		49.9
Highest	(July 17)	92.0	(Aug. 8, 1891)	99.0
Lowest	(Jan. 5)	−21.0	(Feb. 10, 1899)	−21.0
Mean daily range		21.5		20.7
Greatest daily range	(Dec. 28)	48.0	(Oct. 6, 1895)	55.0
Clear days		149.0		132.0
Cloudy days		170.0		127.0
Days rain fell		136.0		128.0
Rainfall (in.):				
Greatest monthly	(Apr.)	6.59	(July, 1896)	8.05
Least monthly	(Nov.)	.40	(Sept., 1897)	.29
Mean yearly				
Prevailing direction of wind		SW.		SW.

	For the State.			
	1904.		1883–1904.	
Temperature (° F.):				
Mean		48.6		50.7
Highest	(July 17 and Sept. 29)	99.0	(July 4, 1897)	113.0
Lowest	(Jan. 4)	−30.0	(Feb. 10, 1899, and Jan. 4, 1904).	−39.0
Mean daily range				
Greatest daily range	(Jan. 5)	54.0	(Sept. 25, 1897)	67.0
Clear days				
Cloudy days				
Days rain fell		117.0		125.0
Rainfall (in.):				
Greatest monthly				
Least monthly				
Mean yearly		35.36		37.17
Prevailing direction of wind		SW.		SW.

Report of the section of climatology of the National Irrigation Congress (*Proc. Nat. Irrig. Cong., 13 (1905), pp. 217–247*).—An account is given of the proceedings of this section at the congress held at Portland August 21–24, 1905, including the following papers:

The Influence of the Chinook on the Climate of Idaho and Montana, by E. L. Wells; Relation of Drought to Forest Fires, by A. B. Wollaber; Rainfall and Irrigation in Foreign Countries, by E. A. Beals; Precipitation Cycles on the Pacific Slope—Their Relation to Droughts and Water Supply for Irrigation Purposes, by G. N. Salisbury; Distribution of Rainfall of the State of Washington, by L. C. Cover; A Drop of Rain, by A. G. McAdie; Influence of Elevation upon Rainfall in California, by G. H. Wilson; and Climatology of the Coast Desert of Peru, by A. F. Sears, sr.

Report of the Eighth International Geographic Congress held in the United States, 1904 (*U. S. House Representatives, 58th Cong., 3. Session, Doc. 460, pp. 1064, pls. 12, figs. 58, maps 6*).—This report, delayed in publication, contains a

number of articles bearing directly or indirectly on agriculture, especially in the line of meteorology and climatology.

Among these are: Meteorological Summary for Agaña, Island of Guam, U. S. A., for the Year 1902, by C. Abbe, jr.; A Climatological Dictionary for the United States, by A. J. Henry; Scientific Work of Mount Weather Meteorological Research Observatory, by F. H. Bigelow; Suggestions Concerning a More Rational Treatment of Climatology, by R. DeC. Ward; The Canadian Climate, by R. F. Stupart; The Climate of Kimberley, by J. R. Sutton; A Project for the Exploration of the Atmosphere over the Tropical Oceans, by A. L. Rotch; Rainfall with Altitude in England and Wales, by W. Marriott; The Climatology of the Lowlands and Watershed Terraces of Natal, by F. W. D'Evelyn; The Climate of Pamplemousses, in the Island of Mauritius, by T. F. Claxton; The Climate of Ts'aidam, by A. Kaminski; Meteorology of Western Australia, by W. E. Cook; and On the Unsymmetrical Distribution of Rainfall About the Path of a Barometric Depression Crossing the British Islands, by H. R. Mill.

Precipitation and storms in the Grand Duchy Saxe-Altenburg, 1900-1904, F. KRÜGER (*Mitt. Osterlande, n. ser., 11 (1905), pp. 51-81*).—Data for monthly and annual precipitation at different places, daily and monthly distribution of rainfall, snowfall, and frequency and distribution of storms are summarized.

The influence of water vapor upon nocturnal radiation, J. R. SUTTON (*Sci. Proc. Roy. Dublin Soc., n. ser., 11 (1905), No. 3, pp. 13-33*).—The author cites evidence to show "that Tyndall's discovery of the absorption and radiation of heat by the vapor of water has been too hastily applied to meteorological problems," and summarizes the results of a series of observations at Kimberley on the absolute and relative humidity at 8 p. m. as related to the subsequent fall of temperature, from which the conclusion is drawn that there is "no trace of a fall of temperature depending upon the quantity of moisture present."

The observations "show a relationship between the nocturnal cooling of the air and the relative humidity, but not any relationship at all to the absolute humidity. . . . It is a dry air which, of itself, *à priori* because of its feeble radiative power, should cool more slowly than a damp air. We have then to establish a connecting link between these two facts. It is to be found, it seems, in the dependence of the cooling of the ground upon the hygrometric state of the air."

Observations on the surface cooling between 8 and 11 p. m. of a "bare patch of red sand" show that comparing the falls of soil temperature with the relative humidity it was found "that a simple division by three gives practically the same value as those for the cooling of the air, so long as the air is not more than half saturated. For humid states in excess of this, the air cools faster than the ground.

"The falls of earth-temperature as compared with the dew-point are of exactly the same nature in the two series as those of the cooling of the air, namely, that they increase at first to a dew-point of about 40-45°, after which they decrease again. The explanation is that the humidity of the air chances to have on the whole its minimum values when the dew-point is about 40-45°.

"We see, then, that the lower air takes its temperature chiefly from the ground, but that the great radiative power of its contained water vapor, when the relative humidity is high, lowers its temperature somewhat faster than it can absorb radiation from the ground."

Contributions to the hydrology of eastern United States, 1905, M. L. FULLER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 145, pp. 220, pls. 6, figs. 42*).—This is the third of a series of progress reports relating to the hydrology of the eastern portion of the United States (E. S. R., 16, p. 1031). It contains the following contributions:

Hydrologic Work in Eastern United States and Publications on Ground Waters, Two Unusual Types of Artesian Flow, Construction of So-called Fountain and Geyser Springs, A Convenient Gage for Determining Low Artesian Heads, A Ground-

water Problem in Southeastern Michigan, and Notes on Certain Large Springs of the Ozark Region, Missouri and Arkansas, by M. L. Fuller; Drainage of Ponds into Drilled Wells, by R. E. Horton; Water Resources of the Catatonk Area, New York, by E. M. Kindle; Water Resources of the Pawpaw and Hancock Quadrangles, West Virginia, Maryland, and Pennsylvania, by G. W. Stose and G. C. Martin; Water Resources of the Nicholas Quadrangle, West Virginia, by G. H. Ashley; Water Resources of the Mineral Point Quadrangle, Wisconsin, by U. S. Grant; Water Resources of the Joplin District, Missouri-Kansas, by W. S. T. Smith; Water Resources of the Winslow Quadrangle, Arkansas, by A. H. Purdue; Water Resources of the Contact Region Between the Paleozoic and Mississippi Embayment Deposits in Northern Arkansas, by A. H. Purdue; Water Resources of the Portsmouth-York Region, New Hampshire and Maine, by G. O. Smith; Water Supplies at Waterloo, Iowa, by W. H. Norton; Water Supply from Glacial Gravels near Augusta, Me., by G. O. Smith; Water Supply from the Delta Type of Sand Plain, by W. O. Crosby; Waters of a Gravel-filled Valley near Tully, N. Y., by G. B. Hollister; and Notes on Certain Hot Springs of the Southern United States, by W. H. Weed.

Concise summaries of the papers are given.

The underground waters of Mississippi—a preliminary report, W. N. Logan and W. R. Perkins (*Mississippi Sta. Bul. 89, pp. 112, figs. 23*).—This is a preliminary report on the underground waters of Mississippi, embodying "present knowledge of the depth at which potable underground waters may be obtained in different parts of the State; the known and probable artesian areas of the State, and the chemical properties of the underground waters in various parts of the State."

The bulletin discusses precipitation and streams as sources of underground water supply, describes the drainage basins of Mississippi and the geological position and character of the water-bearing strata of the State, classifies the underground waters with reference to chemical position, and outlines the principal artesian areas of the State.

"The principal drainage areas of the State are: The Tombigbee basin, drained by the upper part of the Tombigbee River and its branches; the Pascagoula basin, drained by the Pascagoula River, which is formed by the conjunction of the Leaf River and the Chickasawhay River; the Pearl River basin, draining to the Gulf through Lake Borgne; the Big Black basin, draining to the Mississippi (the smallest of the basins); the Yazoo basin, draining to the Coldwater, the Tallahatchie, the Yallobusha, and the Yazoo, and entering the Mississippi, which receives the drainage of the western part of the State."

The underground waters are classified as follows: "(1) Mississippi bottoms.—The water from this region is on the whole carbonate, sodium carbonate predominating. (2) Tombigbee basin.—The waters of this basin belong to the soft-water group. The amount of solid matter usually falls below 10 gr. per gallon. (3) The northeast prairie region.—These waters are chlor-carbonate. There is a predominance of sodium carbonate and sodium chlorid. (4) The Chickasawhay basin.—The waters of this basin are carbonate waters. (5) The Gulf Coast.—The waters of the Gulf Coast are chlor-carbonate. Sodium chlorid is the predominant mineral. (6) Other parts of the State.—The waters from other parts of the State may be classed in general as soft."

The principal artesian areas are as follows: "(1) The northeastern deep-well area including the Tombigbee artesian basin; (2) the eastern deep-well area including the Chickasawhay and Leaf River artesian basins; (3) the southern deep-well area including the Gulf Coast and lower Pearl River artesian basins; (4) the northwestern deep-well area including the Mississippi bottoms and upper Pearl River artesian basins."

Subartesian water supply, W. G. Cox (*Agr. Gaz. N. S. Wales, 16 (1905), No. 10, pp. 996–1002, figs. 2*).—This article describes methods and machinery used in boring

shallow wells and developing localized subterranean supplies of water in New South Wales.

Field measurements of the rate of movement of underground waters, C. S. SLICHTER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 140, pp. 122, pls. 15, figs. 67*).—This is a revised edition of Water-Supply and Irrigation Paper No. 67 (E. S. R., 14, p. 640), giving somewhat more detailed accounts of apparatus used and results obtained in laboratory studies, as well as of supplemental field investigations.

Destructive floods in the United States in 1904, E. C. MURPHY ET AL. (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 147, pp. 206, pls. 18, figs. 19*).—This report gives data regarding streams and drainage basin, precipitation and temperature, gage height and discharge, character and prevention of damage by floods occurring during the year on the following rivers: Sacramento River, California; Susquehanna River, Pennsylvania; Mohawk River, New York; Grand River, Michigan; Wabash River, Indiana; Belle Fourche River, South Dakota; Kansas, Neosho, Verdigris, Osage, and Arkansas rivers, Kansas; Canadian River basin, New Mexico, Oklahoma, and Indian Territory; Pecos River basin, New Mexico; Rio Grande River, New Mexico; Cache la Poudre and Crow Creek, Purgatory, and La Plata rivers, Colorado.

Similar data are also given for the Johnstown and Robinson Run floods occurring in Pennsylvania and the Troxton Canyon and Globe floods of Arizona. Observations on drought in the Ohio River drainage basin are also recorded, and a method of computing cross-section areas of waterways is described.

The normal distribution of chlorin in the natural waters of New York and New England, D. D. JACKSON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 144, pp. 31, pls. 5*).—This bulletin discusses the physiological functions of common salt, salt (chlorin) as an indication of pollution of water supplies, methods of determining chlorin, and the normal distribution of chlorin in the natural waters of New York and New England as calculated from a large number of determinations collected from various sources.

The bulletin contains a normal chlorin map showing "isochlors" for the different States represented in the region studied. Attention is called to the fact that while chlorin is as a rule a reliable and persistent index of pollution of water "a certain proportion of the chlorin in a water has its origin in natural causes, and has no relation to artificial pollution; therefore, in determining the character of a water for domestic purposes, it is necessary to consider this natural or normal chlorin, and whenever the chlorin present is in excess of the normal the evidence of past pollution is complete.

"It has been found, moreover, that (with the exception of local deposits) the normal chlorin in natural waters is derived from the salt of the ocean, blown over the land by storms, and that it diminishes in amount as the distance from the ocean increases. This decrease is so definite that equal amounts of chlorin are found along lines generally parallel to the seacoast, thus affording a basis for the establishment of isochlors. In Massachusetts and Connecticut these lines have been located, and for several years the information has proved to be of great value to the water-supply interests of those States."

Mineral waters of the United States, J. K. HAYWOOD and B. H. SMITH (*U. S. Dept. Agr., Bur. Chem. Bul. 91, pp. 100*).—This bulletin gives the results of an attempt "to obtain all the most prominent spring waters as they are sold on the market and to compare the composition of such samples with the composition as advertised by the owners of the springs."

A further study of all well-known spring waters collected at their sources is also in progress, and the second part of this bulletin gives the results already obtained on Saratoga waters so sampled. The classification of mineral waters is discussed and the authors propose a classification which differs in certain particulars from those suggested by Peale and Crook. A method of naming mineral waters is also explained

and available knowledge regarding the medicinal value of various classes of such waters is summarized.

Descriptions are given of the analytical methods used in the following determinations: Lithium, potassium, calcium, manganese, iodin, chlorin, sodium, magnesium, iron and aluminum, arsenic, bromin, boric acid, nitric acid, sulphuric acid, carbonic acid, phosphoric acid, nitrous acid, silicic acid, bicarbonic acid, free ammonia, albuminoid ammonia, and oxygen-consuming capacity. "Besides these determinations, barium, strontium, and hydrogen sulphid were determined in cases where there was reason to suspect their presence."

Tables show analyses of 42 samples of mineral waters from leading springs of the United States represented in the open market, together with analyses advertised by the spring owner, or, where they could not be obtained, the analyses given in Crook's Mineral Waters of the United States. The hypothetical form of combination of the constituents is also given in each case, and the general character of the waters as shown by analysis is discussed. Analyses of 13 samples of water from springs at Saratoga, New York, collected by an agent of the Department, are also reported.

The results reported in the first case (with market waters) show "that the composition of waters as determined by the authors is often different from the composition as given in the advertising matter. This does not necessarily mean that there has been any attempt at fraud on the part of the owner of the spring. Sometimes the difference between the analyses may be small and immaterial, falling within the limits of error of analyses by different analysts and the natural change in the composition of the water from time to time.

"Sometimes the difference in analyses may be due to the fact that the advertised analysis was made years ago and that since that time the composition of the water has gradually but steadily changed. On the other hand, these differences may sometimes be due to poor analytical work on the part of the commercial chemist, sometimes to fraud on the part of the retail dealer, and sometimes even to fraud on the part of the spring owner."

The study of the Saratoga waters collected at the springs shows that "(1) the waters are in nearly all cases markedly weaker in mineral content than they were about 35 years ago; (2) there is a great variation in the total mineral content of individual springs from time to time; (3) the rarer elements, such as lithium and bromin, seem to vary to a greater extent than the other elements present."

Purifying drinking water by electricity, R. GUENTHER (*Mo. Consular Rpts.* [*U. S.*], *1905, No. 297, p. 128*).—This is a brief note on a simple apparatus devised by a French engineer named Otto for generating ozone by means of electricity and mixing it with the water to be purified. It is claimed that "the apparatus is capable of purifying about 60 gal. of water an hour, and the cost per hour is about the same as that of an ordinary electric incandescent light."

Copper sulphate for killing green scums, S. AVERY and A. KEYSER (*Breeder's Gaz., 48 (1905), No. 19, pp. 935, 936*).—Experiments at the Nebraska Station in tanks supplying water for stock are briefly reported, the conclusion reached being that "tanks may be kept free from green scums by treating with copper sulphate at least 3 times during the heated portion of the summer. Adding the copper sulphate directly at the rate of ½ lb. copper sulphate to 15 bbls. of water is the more effective method of treatment. Where this treatment is used the copper sulphate should be placed in a coarse sack and drawn back and forth through the water until dissolved."

Estimation of Bacillus coli in potable waters, A. GAUTIÉ (*Ann. Chim. Analyt., 10 (1905), pp. 254–257; abs. in Jour. Chem. Soc.* [*London*], *88 (1905), No. 516, II, p. 660*).—The author claims that correct estimates of the number of this organism present in water can only be made by repeated experiments with varying amounts of water (from 100 cc. to 1 drop). In other respects he follows the usual method of adding peptone broth and a sufficient amount of phenol to prevent the growth of a large number of saprophytic germs.

SOILS—FERTILIZERS.

Alkali conditions in the Payette Valley, J. S. BURD (*Idaho Sta. Bul. 51, pp. 20*).—After a brief discussion of the geography and topography of the Payette Valley, the character of the soils and waters, the occurrence of hardpan, and superficial evidences of alkali, the author reports analyses of 8 samples of well water and examinations with reference to appearance of the soil solution, texture, and percentages of sulphates, chlorids, and carbonates of 107 samples of alkali taken at different depths, from 1 to 4 ft.

The results show that the predominating alkali is of the so-called black variety. In soils whose fertility has been most affected by alkali accumulations the carbonate equivalent was frequently as great as 0.3 to 0.5 per cent, and even in the best lands, producing fine crops, the average amount of sodium carbonate was 0.1 per cent or more. In a few instances sodium chlorid was found to be present in extraordinarily large amounts, 0.5 per cent and over. In general, however, the proportion of this salt was much less than that of sodium carbonate, being only 0.03 per cent or less in good upland soils.

Soluble sulphates were frequently present in large amounts, 0.2 to 0.4 per cent, in the highly contaminated lands, but in the more productive soils they were present in small amounts, as compared with other constituents, frequently running as low as 0.02 per cent or less. The virgin soils as a rule contained smaller amounts of soluble salts in the surface foot than in lower layers. In soils containing much free water the alkali was usually uniformly distributed, but was frequently higher in the surface foot than in other layers. Geographical position seemed to have little influence in determining the character of the alkali.

In general the conclusion was reached that "the amounts of so-called alkali or water soluble salts in the soils of this valley are quite large and offer a serious obstacle to the successful farming of large areas. Prior to artificial irrigation the amounts and distribution of the alkali constituents in the various soils were fairly uniform. Since artificial irrigation commenced, however, there have been radical changes in this respect.

"Irrigation has resulted in improving certain favorably situated soils by working the salts to greater depths or into the drainage or neighboring lands; but on low-lying lands or wherever the natural underdrainage is poor accumulations have been brought about. These accumulations, as has been noted above, consist largely of sodium carbonate. Unfortunately, however, the use of gypsum, the usual antidote for sodium carbonate, is inapplicable here because the amount of resulting sodium sulphate, in addition to the sulphate and chlorid already present, would in most cases still be far above the toxic limit for the crops of this section.

"In even the most favorably situated soils the alkali is quite high, and unless water is sparingly used, or the underdrainage is exceptionally good, the tendency of the salts to come to the surface is soon observed. The topography of certain portions of the area—i. e., the bench lands—is admirably suited to artificial underdrainage, which would probably solve the alkali problem for lands so situated, if it were introduced. It is difficult to see, however, how the low-lying river lands could be successfully underdrained, and for the present at least such lands should be avoided or chosen with great care when intended for agricultural purposes."

The geological survey of Ireland, G. A. J. COLE (*Dept. Agr. and Tech. Instr. Ireland Jour., 5 (1905), No. 4, pp. 619–629, pls. 2, figs. 4*).—A brief account is given of the history, progress, and aims of this survey, which has recently been put under the control of the Department of Agriculture and Technical Instruction for Ireland. It is proposed to give special attention to surface geology and to the preparation of drift and soil maps of districts of special agricultural interest.

The soils of Montserrat, F. WATTS and H. A. TEMPANY (*West Indian Bul., 6 (1905), No. 3, pp. 263-284, dgms. 10*).—Mechanical and chemical analyses of 12 samples of typical soils of the island are reported.

It is stated that the soils of Montserrat, which are of volcanic origin, are "on the whole, fertile and easily worked; they are characterized by containing very small amounts of carbonate of lime, but, otherwise, they are not usually deficient in the elements of plant food." The mechanical analyses show that there is considerable variation in the texture of the soils, some being sandy and easily worked, others stiff and difficult to till. The suitability of the soils to sugar cane, limes, cotton, cacao, rubber, vegetables, etc., is discussed.

An illustration of the use of the wire-basket method for soil testing, F. D. GARDNER (*Science, n. ser., 22 (1905), No. 569, pp. 678-680*).—This article briefly reports a test by the wire-basket method of soil of the Orangeburg clay type from South Carolina in comparison with soil of the same type from Texas.

The results of experiments with wheat, as well as chemical analysis of the soils, indicate that the soil contained too much soluble salts for normal development of the wheat plants. Tests of samples of soils from other portions of the same field indicated that the conditions noted in the first sample were not generally true for the whole area. Neither were they true for the soil of the same type from Texas.

The absorptive power of soils, C. DUSSERRE (*Chron. Agr. Vaud, 18 (1905), No. 18, pp. 463-466*).—A brief general discussion of this subject, referring especially to the investigations of the author and T. Bieler already noted (E. S. R., 16, p. 347).

Chemical-geological investigations on the absorptive properties of decomposed rocks, M. DITTRICH (*Ztschr. Anorgan. Chem., 47 (1905), No. 2, pp. 151-162*).—In continuation of previous investigations (E. S. R, 14, p. 746), the author reports results of studies of the effect of weathering on the solubility of the various constituents of rocks in water, weak acids, and neutral salt solutions of various kinds.

A study of fresh and weathered hornblende granite showed that while the percentages of lime and soda had been decreased to a marked extent by weathering, the percentage of potash was decidedly increased. Extraction of the weathered product with water and weak acids showed that the potash was combined in highly insoluble form, the solubility in weak acids being but slightly greater than that in water. Digestion of fresh and weathered rock of various kinds with $\frac{1}{10}$ normal sodium chlorid solution resulted in solution of only a trace of potash but of considerable amounts of calcium and magnesium, the latter being replaced by an equivalent amount of sodium.

Treatment with $\frac{1}{10}$ normal potassium chlorid solution resulted in the solution of considerable amounts of calcium and magnesium, corresponding as a rule with the stage of weathering of the rock. In all cases the amounts of calcium, magnesium, and sodium removed in solution were replaced by an equivalent amount of potash. This potash was partly but not completely removed by a subsequent prolonged extraction with water.

Studies are also reported of the solubility in solutions of ammonium chlorid (concentrated), lime water, and calcium chlorid (2 per cent and tenth-normal) of the potash which occurs in what is known as soil zeolites and which is generally considered soluble in the soil solutions and available to plants. The studies were made with both unaltered rock and with rock which had been artificially enriched in potash.

The calcium chlorid solutions (either 2 per cent or tenth-normal) were found to be more active solvents than acetic acid and dissolved further amounts of lime, potash, and soda from material which had previously been completely exhausted with ammonium chlorid solution. The potash removed corresponded to that in form of zeolites.

Investigations on the insoluble alkali compounds originating in the humus substances of the soil and their rôle in plant physiology and agriculture,

Berthelot (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 10, pp. 433–445; abs. in Chem. Centbl., 1905, II, No. 17, pp. 1281, 1282*).—The author calls attention to the occurrence in living plants, soils, and composts of insoluble potash compounds which can also be prepared by the direct action of potash on artificial humic acid.

He reports studies of the composition of humic acid, artificially prepared by the treatment of sugar with concentrated hydrochloric acid, both in the fresh state and after standing several years and undergoing oxidation; of an amido acid resulting from the action of ammonia on fresh humic acid; and of humus compounds occurring in dead forest leaves, and in composts; as well as the behavior of these substances when macerated hot or in the cold with large quantities of pure water, dilute solutions of potassium chlorid, calcium chlorid, potassium acetate, and calcium acetate, and distilled with water and saline solutions (chlorids and acetates).

Artificial humic acid prepared as described has, according to the analyses reported, the following formula—$C_{18}H_{14}O_6$; and is of the nature of the lactones. When distilled with water a small amount of volatile matter similar to the acroleins is driven off. No furfurol is formed. When distilled with potassium acetate a part of the acetic acid is set free, the potash forming compounds insoluble in water. Distillation with potassium chlorid solution gave the same results as with pure water. Old oxidized humic acid gave the same results as fresh.

Treatment with dilute solutions of potassium acetate and calcium acetate resulted in the formation of insoluble compounds of these bases, while maceration or distillation with potassium chlorid or calcium chlorid produced no perceptible effect. Two days' treatment of fresh humic acid with dilute solutions of potassium chlorid and ammonia gave an almost neutral solution and a compound insoluble in cold water which contained 63.66 per cent of carbon, 4.34 per cent hydrogen, 0.98 per cent nitrogen, 3.22 per cent potash, and 27.8 per cent oxygen. Of the 11.75 parts of potash used, 3.21 parts had become insoluble and of 3.5 parts of nitrogen used 0.82 part had become insoluble.

In experiments with water and soda solution extracts of leaves and compost it was found that distillation with water and a dilute solution of potassium chlorid resulted in a neutral solution and the formation of small amounts of furfurol. Distillation with potassium acetate resulted in the formation of free acetic acid. Maceration with potassium chlorid and potassium acetate resulted in a considerable increase of insoluble potash and soluble lime, while treatment with calcium chlorid and calcium acetate increased the amount of insoluble lime, and in case of the compost reduced the amount of insoluble potash. The importance of these insoluble compounds of potash and of lime with humic acid and analogous substances from the standpoint of the processes going on in cultivated soils and from that of plant growth is discussed.

Peat and its products, W. A. Kerr (*Glasgow: Begg, Kennedy & Elder, 1905, pp. XVI + 318, pls. 25*).—"The aim of this work is to direct general attention to the economy of peat as a substitute of coal and for the development of its numerous by-products"

It contains introductory chapters defining peat and explaining its commercial importance in Great Britain. Other chapters discuss peat as an article of fuel, peat charcoal or peat coal, gas from peat, electricity from peat, how to use peat fuel, peat moss litter, peat as a manure, peat bricks and earthenware, the germ-destroying action of peat-moss litter and peat dust treated with acids, health-giving properties of peat, reclamation of bogs and moors, and how to work a peat bog. Articles on the distillation of peat, utilization of the peat bogs of Ireland for the generation and distribution of electrical energy, and state aid to industry (including "Gewerbe" museums and cottage industries) are given in appendixes.

The scattered literature of the subject is quite fully reviewed in this book and rather complete details are given of construction of machines and of processes employed in the manufacture of various products from peat.

Manurial requirements of the Cecil silt loam of Lancaster **County, S. C.**, F. D. GARDNER and F. E. BONSTEEL (*U. S. Dept. Agr., Bur. Soils Circ. 16, pp. 7*).—This circular reports results of tests by the wire-basket method of the effect on the green weight and transpiration of wheat plants (grown 20 to 25 days) of cowpeas 2½ and 5 tons; nitrate of soda, sulphate of potash, and acid phosphate 200 lbs. each, alone or in combination with one another and with lime; barnyard manure 10 tons, alone and with 1 ton of lime; and lime alone 1 ton, on Cecil silt loam from a plantation which had formerly been subjected to exhaustive culture but in recent years had been considerably improved through the raising of live stock, diversification of crops, better cultivation, and the construction of terraces and ditches to prevent destructive washing.

The particular soil used was a yellowish brown or gray mellow silt loam usually free from stone. "It contains sufficient clay to clod and bake badly if stirred in too wet condition, but if plowed in proper moisture condition it is mellow and fine. The subsoil to more than 3 ft. deep is a bright-red, massive silty clay loam or clay, crumbling readily when dry, especially in the upper portion, but becoming more plastic and tenacious in the lower."

Mechanical analyses of this type of soil are given, but no data regarding its chemical composition.

The results of the wire-basket tests show that the cowpeas and nitrate of soda were most effective in increasing the productiveness of the soil. Neither acid phosphate nor sulphate of potash gave any appreciable increase in growth.

"Thinking that there might be a residual effect from the fertilizer, certain of the treatments were replanted with wheat without repeating the fertilizers. In case of the untreated soil the second crop was reduced in yield to 65 per cent of the first, whereas the reduction in yield with a complete fertilizer either with or without lime fell to 36 per cent of the original yield which was produced with the fertilizer. In fact, the second crop in the baskets to which fertilizer had been originally applied was very slightly greater than was the second crop on the untreated soil, which shows that the effect of the commercial fertilizer was practically exhausted by the first crop. It is also worthy of mention in this connection that it is impossible even by repeating the fertilizer to secure as large a yield in the second or the third crop as was originally secured with the treatment in the first crop."

The increase of stock raising as well as the larger use of leguminous plants for green manuring are recommended as practical means of increasing the productiveness of this class of soils.

Manurial requirements of the Portsmouth sandy loam of the Darlington area, South Carolina, F. D. GARDNER and F. E. BONSTEEL (*U. S. Dept. Agr., Bur. Soils Circ. 17, pp. 10*).—The character and previous treatment of the soils of a representative plantation in this area are described and experiments with a sample of the soil by the wire-basket method to test the effect of different systems of manuring on the growth of wheat are reported. The fertilizing material used included cowpeas and lime alone and in combination, barnyard manure with and without addition of lime, and sodium nitrate, potassium sulphate, and acid phosphate in various combinations with one another and with lime.

The results show "that this soil, although thoroughly cultivated, well supplied with commercial fertilizers, and subject to a systematic rotation of crops, in which cowpeas are frequently grown, has responded in a marked degree to many of the manurial treatments. Cowpeas have produced decidedly the largest increase in growth, applications of 2½ tons and 5 tons giving increases of 57 and 104 per cent, respectively, and by supplementing this treatment with small amounts of lime, the gain has been increased to 99 and 138 per cent."

Lime alone produced very marked results, and when used in combination increased the effect not only of cowpeas, but of a complete commercial fertilizer consisting of

200 lbs. per acre each of sodium nitrate, potassium sulphate, and acid phosphate. The smaller applications of lime (1,000 lbs. per acre) gave a slightly larger increase than applications of 2,000 lbs. per acre. The lime produced nearly twice as much gain when used with a complete fertilizer as when used alone.

"Barnyard manure has given a considerable increase, but from the economical standpoint is not equal to cowpeas and lime, and, furthermore, its use is restricted for want of supply."

To test the residual effects of the various treatments a number of the baskets were replanted without further addition of fertilizing materials. The most striking feature of the results was "the marked reduction in the growth of the second crop, which is frequently less than half what it was in the first instance. The relative growth as affected by the treatments is essentially the same in both crops, but there has been a marked reduction regardless of the treatment. In only two out of eight instances has the residual effect been sufficient to exceed or equal the original growth on the untreated soil."

It is stated that the results obtained in these experiments "seem to be thoroughly in accord with the observations that have been made in the field and with the experience of the planters in Darlington County."

Liming soils (*Ann. Rpts. Bd. Agr. Del., n. ser., 3-4 (1903-4), pp. 123-128*).—A general discussion of this subject, based largely on the work of the Rhode Island Station, as summarized in Farmers' Bulletin 77 of this Department. Attention is called to the advantages of the method somewhat recently introduced of applying finely ground, freshly burned lime before it has been slaked to the soil by means of a grain drill.

On the action of the water-soluble mineral constituents of plant residues on the soil, S. Krawkow (*Jour. Landw., 53 (1905), No. 3, pp. 279-288*).—Analyses of water extracts of fine-ground oak leaves before and after passing through a marly soil showed that sulphuric acid, potash, magnesia, and phosphoric acid were freely dissolved from the leaves, the lime and silica in only small amounts, iron oxid in moderate amounts.

The soil absorbed from the leaf extract large amounts of the potash (58 per cent), phosphoric acid (69 per cent), magnesia (38 per cent), and organic substances. The latter, however, were removed by repeated washing. Silica, manganese oxid, soda, and iron oxid were not absorbed by the soil. Considerable amounts of lime and sulphuric acid were removed from the soil by the leaf extract, due to exchange of bases and the action of organic acids.

Soil inoculation.—Tubercle-forming bacteria of legumes, L. L. Lewis, J. F. Nicholson, et al. (*Oklahoma Sta. Bul. 68, pp. 30, figs. 8*).—The investigations here recorded included a series of pot experiments with sterilized soil to study (1) effect of cultivation and composition of media on the activity of the germ from the alfalfa plant; (2) nature of the organisms from the cowpea and the soy bean, and of a commercial culture; (3) cross inoculation, or the inoculation of one plant with cultures obtained from another; (4) normal distribution of the tubercle-forming bacteria of the legumes in the United States; (5) ability of the tubercle-forming bacteria to increase the nitrogen content of culture media in which they are grown; (6) methods of sending out cultures; (7) cultural characters of the tubercle-forming bacteria of the legumes.

Methods of determining nitrogen in the cultures and the results obtained in a series of analyses are also given, as well as the cultural characteristics of the tubercle-forming bacterium (*Pseudomonas radicicola*) of legumes. The results obtained are believed to justify the following conclusions:

"(1) Soil inoculation with cultures of the tubercle-forming bacteria is practicable only when other conditions are favorable for plant growth.

"(2) It is possible to grow these bacteria for at least thirty to thirty-five generations on special media without materially lessening their activity.

"(3) Some cultures examined in the laboratory purporting to be cultures from the alfalfa plant do not contain the germ from the alfalfa plant at all, but are cultures of a soil organism resembling the germ from alfalfa in some particulars.

"(4) The tubercle-forming bacteria of the legumes are easily destroyed by light, consequently inoculated seed should be kept in the dark until used.

"(5) Since some of the ordinary soil bacteria form colonies very similar to those of the tubercle-forming bacteria and also resemble them to a certain extent in being vacuolated, every culture, from which subcultures are to be made for distribution, should be tested in pot experiments."

Soil inoculation, L. L. Lewis, J. F. Nicholson, et al. (*Oklahoma Sta. Bul. 68, popular ed., pp. 9, fig. 1*).—This is a popular summary of the bulletin noted above.

The quality of commercial cultures for legumes, H. A. Harding and M. J. Prucha (*New York State Sta. Bul. 270, pp. 345–385*).—This bulletin gives the results of bacteriological examinations in the laboratory of the New York State Station, and in four other laboratories in different parts of the country, of 18 packages of the inoculating material for legumes formerly distributed in a dried condition upon cotton by this Department and put on the market by commercial concerns.

The examinations made it very evident that the packages were worthless for practical purposes, substantially identical results upon 6 of the packages being obtained in the 5 separate laboratories. "It was shown that the failure of these cultures was inherent in the method of their preparation rather than in any knavery of their producers. While these results will explain the many failures from the use of cotton cultures, they should not be understood as being opposed to the idea of treating the seed of legumes with living bacteria."

Commercial cultures for legumes not reliable, F. H. Hall, H. A. Harding, and M. J. Prucha (*New York State Sta. Bul. 270, popular ed., pp. 10, fig. 1*).—A popular summary of the above bulletin.

Soil bacteria, A. A. Brown (*Jour. Dept. Agr. Victoria, 3 (1905), No. 6, pp. 426–437, figs. 3*).—A general discussion of this subject, based largely upon Conn's treatises (E. S. R., 13, p. 623; 15, p. 74).

The micro-organisms of the soil, M. E. Kayser (*Ann. Sci. Agron., 2. ser., 10 (1905), I, No. 3, pp. 432–449*).—This is a review of investigations relating to nitrification, denitrification, and fixation of nitrogen (symbiotic and nonsymbiotic).

The nitrogen feeding of agricultural plants, Wein (*Chem. Ztg., 29 (1905), No. 80, pp. 1066, 1067*).—This is an abstract of a report before the section of agricultural chemistry of the Society of German Naturalists and Physicians at the meeting at Meran, September 24–30, 1905.

The report discussed methods of conducting field experiments with fertilizers and of interpreting the results. Summarizing the results obtained in comparative tests of nitrate of soda, ammonium sulphate, and lime nitrogen on field, garden, and forcing crops, the following conclusions are drawn:

(1) Lime nitrogen is as a rule not suited to top-dressing, but should be plowed in to a moderate depth when applied. (2) With field crops lime nitrogen is only from 75 to 90 per cent as effective as nitrate of soda; with garden crops it is as effective as nitrate of soda. (3) Sulphate of ammonia is as a rule as effective as nitrate of soda except in case of small fruits, on which it is less effective than either nitrate of soda or lime nitrogen. (4) This lower effectiveness is not believed to be due to evaporation of ammonia, since lime nitrogen suffers a greater loss in this respect than ammonium sulphate. The lower efficiency of the ammonium sulphate is believed to be due to the injurious effect of the sulphuric acid of the salt. (5) The liberal use of complete fertilizers affords a protection against frost and freezing, although

there is no evidence of any specific power of protection against frost possessed by potash fertilizers or nitrate of soda per se. (6) Forcing crops are in their early stages of growth sensitive to lime nitrogen. (7) On moor soils which contain as much as 7 per cent of free humic acids the use of lime nitrogen results in transformations which hinder the utilization of the nitrogen during the first season, followed by an increased action the second season. Moor soils which contain considerable amounts of calcium carbonate utilize the nitrogen of lime nitrogen normally the first year. (8) Lime nitrogen is not suited to the manuring of grass lands.

The report also refers to experiments carried on in cooperation with Hiltner in which inoculation of soy beans on moor soils prevented normal development.

On the loss of nitrogen in liquid manure and its prevention by means of superphosphate, H. Björn-Andersen (*Tidsskr. Landökonom., 1905, No. 3, pp. 160–168*).—The loss of nitrogen during storage can be largely avoided by the use of well-closed cisterns. The losses due to volatilization of ammonia compounds when the liquid is spread can not, however, be wholly overcome, and vary with the character of the soil, temperature, subsequent rainfall, etc.

Laboratory experiments conducted by the author showed that the loss of nitrogen may be considerably decreased through the addition of 2 per cent superphosphate, but that double this quantity is required in order to entirely prevent a loss of ammonia. The losses sustained after addition of varying amounts of superphosphate were determined by the author.—F. W. Woll.

Nitrates and nitrites as fertilizers, T. Schloesing, Jr. (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 20, pp. 745, 746*).—Attention is called to recent development in methods of preparing nitric acid from the nitrogen of the air by means of electricity, and especially to the process of Birkeland and Eyde, which promises to be of some commercial importance and to be able to furnish considerable quantities of calcium nitrate to replace the rapidly disappearing deposits of nitrate of soda.

The calcium nitrate prepared by the process referred to contains about 13 per cent of nitrogen, a part of it being in the form of nitrite. The fertilizing value of this material was compared with that of nitrate of soda and of a mixture of sodium nitrite and calcium nitrite in pot experiments with corn. The results show that the different applications were about equally effective in increasing the yield of corn.

On the use of leucite as a fertilizer, E. Monaco (*Staz. Sper. Agr. Ital., 37 (1904), No. 11–12, pp. 1031–1034; abs. in Centbl. Agr. Chem., 34 (1905), No. 10, p. 714*).—Analysis of the material experimented with showed 1.08 per cent of lime, 7.94 per cent of sodium, and 5.06 per cent of potash. When treated with ammonium nitrate, gypsum, peat, carbonated water, and spring water considerable amounts of these constituents were rendered soluble, indicating that the leucite even in freshly ground condition contains considerable amounts of assimilable plant food.

Experiments with Thomas-ammonium-phosphate lime, E. Haselhoff (*Landw. Jahrb., 34 (1905), No. 3–4, pp. 616–623, pl. 1*).—This material, which is described as a mixture of Thomas slag and ammonium sulphate mixed with siliceous powder (*Kiesilguhr*) and some oily substance such as petroleum to prevent the volatilization of ammonia, was studied with reference to stability of the ammonia compounds, and was also tested with reference to fertilizing value in pot experiments with wheat and barley on sandy loam soils.

The material used contained 5.94 per cent of total nitrogen, 5.66 per cent being soluble, 7.68 per cent of total phosphoric acid, and 28.9 per cent of lime. In closed bottles the loss of nitrogen was small even after the lapse of 1½ years, but in an open flask, porcelain dish, or linen bag the loss was very large within 4 weeks. The results show the material to be a very effective fertilizer, but its value in practice will depend upon the price at which it can be bought.

Comparative tests of Thomas slag and agricultural phosphate, Kuhnert (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 42, pp. 334, 335*).—In plat tests with rye

the Thomas slag (16 per cent citric acid soluble in phosphoric acid) gave much better results during the first year than agricultural phosphate (ground crude phosphate containing 25 per cent total phosphoric acid).

Sources of supply and methods of manufacture of phosphates and potash salts, E. B. VOORHEES (*Jour. Franklin Inst., 160 (1905), No. 3, pp. 211-215*).—Brief accounts are given of the various sources of supply of natural phosphates, especially in the United States, and of the Stassfurt potash deposits. The condition of the phosphoric acid in different kinds of phosphates and their suitability for the manufacture of fertilizers are discussed, as well as the manufacture of refined potash salts from the crude salts and their use in the manufacture of fertilizers.

Experiments with various potash fertilizers, E. HASELHOFF (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 647-664, pl. 1*).—An account is given of comparative pot tests of potassium chlorid, potassium sulphid, potassium phosphate, potassium nitrate, kainit, and 40 per cent potash salts, applied to potatoes followed by wheat. The potash salts were used in connection with a basal fertilizer mixture containing the necessary amounts of nitrogen and phosphoric acid. The fertilizers were applied only to the potato crop, their after-effect being observed on the wheat.

The data reported include yield and composition of the tubers and vines of the potatoes and straw and grain of the wheat, the data for composition being used especially as a basis for studying the relative rates of assimilation of potash and soda in the different parts of the plants and with the different fertilizer combinations. All of the potash fertilizers increased the yield of potatoes, but the results were not conclusive as to the relative effectiveness of the different potash salts in this respect. Two varieties of potatoes were used in the experiments, Gloria and Magnum bonum, and the results show that the relative efficiency of the fertilizers varied with the variety of the potato grown.

A partial substitution of potassium chlorid by sodium chlorid resulted in a small increase in yield, but when the amount of sodium chlorid was further increased there was a decrease in yield. There was no after-effect of the potash salts on spring wheat in one series of experiments and but a slight after-effect was observed in a second series. The after-effects of substitution of sodium chlorid for potassium chlorid were the same as with the first year's crop. The amount of potash taken up by the plants varied with the different salts. The smallest amount of potash was taken up by potatoes from the kainit, but during the following year the wheat assimilated the largest amount of potash on the plat which had received kainit the previous year.

Sodium, whether applied in the form of sodium nitrate or sodium chlorid, was taken up by both potatoes and wheat, and resulted in an increase of the sodium content of both vines and straw and tubers and grain, the increase in case of the grain being especially noticeable. The amount of soda assimilated varied with the amount applied and its relation to the amount of potash present. It appears probable that by the application of sodium chlorid or potash salts containing sodium chlorid the potash of the soil is rendered soluble and more easily assimilated by the plants.

The availability of mixed fertilizers, W. F. SUTHERST (*Chem. News, 92 (1905), No. 2395, p. 185*).—The solubility in 1 per cent citric acid of the phosphoric acid of bone and various mixtures of bone and muriate of potash, kainit, nitrate of soda, sulphate of ammonia, and salt is reported. The results show that the availability of the phosphoric acid was increased in some cases and decreased in others by mixing the bone with the chemicals.

In case of bone meal containing a considerable amount of organic matter the solubility of the phosphoric acid in 1 per cent citric acid was decreased by admixture of muriate of potash, kainit, and salt. In case of bone flour containing a small amount of organic matter the admixture of the chemicals in every case increased the

solubility of the phosphoric acid, the increase being especially marked in the case of nitrate of soda.

Inspection and analyses of commercial fertilizers on sale in the State, W. F. HAND ET AL. (*Mississippi Sta. Bul. 91, pp. 54*).—This bulletin gives tables of analyses of fertilizers inspected during the season of 1904–5, being the fourth publication of analyses of samples of fertilizers drawn during that season.

AGRICULTURAL BOTANY.

The sensitiveness of the chlorophyll of plants tolerant and intolerant to shade, W. LUBIMENKO (*Rev. Gén. Bot., 17 (1905), No. 201, pp. 381–415, pls. 2, fig. 1*).—Experiments are reported in which the author sought to establish the minimum of light intensity required for carbon dioxid decomposition by a number of species of plants.

The subjects of the experiments were Scotch pine and birch representing intolerant species, and fir and linden as those tolerant of shade. The choice of these species was made so that the results obtained with the evergreen trees would be comparable, as would also those obtained with the deciduous species. These different trees were observed under artificial conditions of light and under natural conditions of very diffused light, strong light, and full sunlight.

For the intolerant species the average results show that the energy of carbon assimilation increases with the intensity of light, while for the tolerant species there is an optimum which corresponds to the angle of inclination of the leaf surface to the sun's rays.

Summarizing his investigations the writer concludes that the curve of photosynthesis may be determined from the anatomical structure of the leaf and from specific qualities of the chloroplasts. The influence on the anatomical structure may be seen through all degrees of illumination. Of the species studied the birch and linden assimilated more carbon dioxid per unit of leaf weight than the pine and fir under conditions of average illumination. The specific qualities of the chloroplasts predominated where the illumination was very feeble or very intense. The tolerant species, linden and fir, began assimilation with much less illumination than the intolerant birch and pine. In the more intense light the assimilation of the tolerant species decreased, while for the intolerant ones it continued to increase with the illumination.

A microscopic examination of the leaves showed that the chlorophyll grains of the tolerant species were decidedly larger than those of the intolerant varieties. A spectroscopic examination of alcoholic solutions of the chlorophyll of the leaves showed important differences, the spectra and curves of absorption being almost in direct relation to the carbon dioxid decomposition. The author, in conclusion, says that the terms tolerant and intolerant should be considered with reference to the carbon dioxid decomposition of the species. The leaves of intolerant species require more light in order to compensate for their greater respiration.

The influence of sunlight and diffused light upon the leaf development of deciduous trees and shrubs, J. WIESNER (*Sitzber. K. Akad. Wiss. [Vienna], Math. Naturw. Kl., 113 (1904), No. 8–9, pp. 469–494*).—In continuation of his photometric investigations, the author describes experiments with *Robinia pseudacacia*, *Amorpha fruticosa*, and *Broussonetia papyrifera* grown in full sunlight and in varying degrees of diffused light, the object being to determine the minimum of light required by these plants for the beginning of leaf development and for sustaining it throughout the growing season.

Regeneration in roots, B. NĚMEC (*Studien über die Regeneration. Berlin: Borntraeger Bros., 1905, pp. 387, figs. 180; rev. in Nature [London], 73 (1905), No. 1886, pp. 170, 171*).—This volume gives the results of investigations carried on to throw some light upon the nature of the processes of regeneration, the causes that initiate

and determine its occurrence, and the meaning of the physiological events that are associated with it.

In the investigations the tips of growing roots, especially seedlings, were injured in various ways by making incisions into the region about the apex, and the reactions were carefully examined and compared. The work suggests a number of important problems for future investigation, and contains an extended bibliography of literature relating to the subject.

The absorptive capacity of roots in the light and in the dark, E. PANTANELLI (*Landw. Jahrb., 34 (1905), No. 3-4, pp. 665-683*).—Seedlings of various plants, including *Zea mays*, were placed in the dark and also in the light to determine the influence of darkness upon the absorptive capacity of the roots.

It was found that when the seedlings were kept in the dark the roots took up absolutely less, but relatively more, salts than water, while in the light the reverse took place. When the stems and leaves alone were exposed to the light the roots absorbed more water while the salt absorption was relatively decreased, but when the roots alone were subjected to the action of light they took up more salt than water. These results are regarded as indicating that the use of mineral substances by the plant is not regulated by transpiration alone, and that the roots have the power of changing the relation of salt to water absorption according to conditions. The selective capacity of the living organism manifests itself in such cases.

A study of the injury to plants by fumes from industrial works, P. SORAUER (*Landw. Jahrb., 33 (1904), No. 4-5, pp. 585-664, pls. 4*).—The results are given of a prolonged study of the effects of fumes from industrial works, especially the effects of chlorin and hydrochloric-acid fumes, on wheat, oats, and barley.

The author describes at length the various anatomical changes observed in these different plants wherever any departure from normal structures was noted. These include changes due to ripening, injury, fungi, overfertilization, superabundant water, etc., comparisons being made with injuries attributed to noxious fumes and with the changes experimentally produced upon the plants under observation when exposed to chlorin and hydrochloric-acid fumes.

Summarizing his observations, the author says that the injuries due to fumes differ only in degree from those observed on similar plants not subjected to the influence of gases. The distinction between injured and uninjured plants is a quantitative one, and can only be determined by comparisons with similar plants grown in regions known to be free from injurious fumes.

Pot experiments to determine the limits of endurance of different farm crops for certain injurious substances, F. B. GUTHRIE and R. HELMS (*Agr. Gaz. N. S. Wales, 16 (1905), No. 9, pp. 853-860*).—Pots were filled with a rich garden loam mixed with a nearly equal quantity of light sand and fertilized with 10 gm. of superphosphate. To these pots were added different quantities of sodium chlorid, sodium carbonate, sodium chlorate, and arsenious acid, and the effect on the germination and growth of barley and rye was observed. The results obtained are shown in the following table:

Effect of different percentages of injurious substances in the soil on the germination and growth of barley and rye.

	Sodium chlorid.		Sodium carbonate.		Sodium chlorate.		Arsenious acid.	
	Barley.	Rye.	Barley.	Rye.	Barley.	Rye.	Barley.	Rye.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Germination affected	0.10	0.10	0.25	0.25	0.005	0.004	....	0.20
Germination prevented	.25	.40	.60	.50	.007	.006	....	....
Growth affected	.10	.15	.15	.25	.003	.002	0.05	.15
Growth prevented	.20	.20	.40	.40	.006	.004	.10	.30

The germination of barley was unaffected by 0.6 per cent of arsenious acid in the soil, while its growth was prevented by a much smaller quantity. The results also showed that it required more than 0.4 per cent of this substance in the soil to affect the germination of rye.

Albinism in the plant kingdom, E. PANTANELLI (*Ztschr. Pflanzenkrank., 15 (1905), No. 1, pp. 1-21*).—A study was made of albinism in plants, as distinguished from chlorosis, blanching, etc. The wide distribution of albino forms of foliage is commented upon and numerous examples are cited. The anatomical changes associated with this abnormal growth are described, and the various theories regarding the cause of albinism are reviewed.

The author believes that albinism is a constitutional disease of the plant, which is not infectious and which is due in the first place to a large accumulation of oxidizing enzyms. It is believed probable that the first accumulation takes place in the stems or roots of the plant, and, so far as the author's investigations go, this is not transmitted through the seed. The oxydases are distributed through definite channels to the leaves, where the chloroplasts are more or less changed and the protoplasm becomes affected, as is shown by its peculiar physical properties.

Chemical investigations show that the protoplasm and its plastids are destroyed through the great abundance of destructive enzyms. Associated with the changed condition of the chlorophyll and the cell plasma, growth is checked. The methods of dissemination and control are to be subjects of further investigation.

The effect of low temperatures on moist seeds, J. ADAMS (*Sci. Proc. Roy. Dublin Soc., n. ser., 11 (1905), No. 1, pp. 6*).—Seeds of peas, barley, flax, Swedish turnips, red clover, meadow fescue, and timothy were inclosed in a cloth and buried in moist soil for 3 days, in order that they might absorb water slowly.

These moist seeds were then divided into different lots, one of which was cooled by evaporating ether and then immersed in liquid air for 23½ hours; a second lot was immersed in liquid air for 24 hours without any preliminary cooling, and a third was inclosed in a small corked bottle and placed in liquid air for 6 hours. A fourth lot, which had not been moistened, was used for comparison.

The seeds of the first and third lots were practically destroyed, with the exception of the timothy. The lot of dry seeds and those not subjected to cooling germinated about normally. In the case of the timothy seeds the author states that they did not absorb water to any appreciable extent, and their prolonged vitality was probably due to this fact.

In discussing the phenomena related to the action of low temperatures on seeds, the author states that the injury was probably due to the withdrawal of water from the cells of the seed and its freezing in the intercellular spaces. Whenever the seeds contained less than 12 per cent of moisture the subjection to liquid air did not seem to be detrimental.

While experiments on dry seeds, spores, etc., seem to show that there is no fatal minimum temperature for dry protoplasm, the author thinks that it is fair to assume that there is a fatal minimum temperature for moist protoplasm and that this minimum is above the temperature of liquid air.

The action of liquid air on the life of seeds, P. BECQUEREL (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 25, pp. 1652-1654*).—The author repeated the experiments of a number of investigators on the effect of intense cold on the life of seed, experimenting with seeds of castor bean, pine, squash, buckwheat, corn, wheat, oats, beans, lupines, peas, vetches, alfalfa, and radish.

Different lots were placed under varying conditions in liquid air, where they were kept for 130 hours at temperatures varying from −185 to −192° C. At the expiration of this time their viability was tested, and the results show that the resistance of seed to low temperatures depends on the amount of water and gas present in their

tissues. If there is sufficient water and gas present the cold disorganizes the protoplasm and nucleus, making germination impossible, but if the protoplasm by drying has reached its maximum concentration and at the same time its minimum activity, the action of low temperatures is not injurious to the seed, which still retain their germinating power.

FIELD CROPS.

Cooperative fertilizer experiments, 1904, P. Bolin (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), Bihang, pp. 117*).—Cooperative fertilizer experiments conducted under the direction of the Royal Academy of Sweden at a large number of farms in different parts of the country are reported. In all, 280 experiments, comprising 149 with small grains, 90 with root crops, 36 with meadows, and 5 with winter grains, and aggregating 7,100 plats, were made. Earlier work in this line has been previously noted (E. S. R., 15, p. 569).

Experiments with oats on clay soils showed that the largest and most economical returns were obtained from the use of 178 lbs. of nitrate of soda, 267 lbs. of superphosphate, and 89 lbs. of 37 per cent potash salt per acre. As in the previous year, nitrate of soda was most effective, every 100 lbs. of this fertilizer giving an average increase of 300 lbs. of grain and a corresponding weight of straw. Superphosphate was of appreciable effect when applied in connection with nitrate of soda, while potash did not generally prove profitable either on clay or sandy soils. General experience teaches that oats are relatively little affected by potash fertilization. On humus and moor soils applications of 89 lbs. of nitrate of soda, alone or with 178 lbs. of superphosphate, per acre gave more satisfactory financial returns, but the highest yields were obtained where the complete application mentioned above was used. Barley on sandy or peaty soils readily responded to the use of potash.

The results also indicated that on rather heavy soils the nitrate of soda is better applied all at one time before sowing, even when as much as 178 lbs. per acre is used. The smaller application, 89 lbs. per acre, produced especially favorable results when used in this way as compared with its use as a top-dressing. On the lighter soils, however, a top-dressing of 89 lbs. per acre was completely utilized by the crop. The results again indicated that a top-dressing with nitrate of soda has a tendency to increase the yield of straw rather than that of grain as compared with applications of like amounts before sowing.

The average results for 2 years showed that 267 lbs. of nitrate of soda (half applied as a top-dressing), 267 lbs. of superphosphate, and 356 lbs. of potash salt per acre produced the heaviest yields of potatoes on sandy soils. As observed in previous experiments, the starch content stood in inverse ratio to the yield, but the largest total yield of starch per acre was obtained on the fertilized plats. The results indicated that in general potatoes grown for factory purposes are more profitable when a medium application of fertilizers is used than when heavy applications are given for the production of a maximum crop.

Mangels grown on humus soils responded most readily to phosphatic fertilizers. The heaviest yields were obtained from the use of 89 lbs. of nitrate of soda, 356 lbs. of superphosphate, and 267 lbs. of potash salt per acre.

On meadows where grasses predominated, especially on soils low in nitrogen, the most economical results were generally obtained by applications of nitrate of soda, while in fields where the stand consisted largely of clover and the soil was high in organic compounds, phosphates and potash produced the best results.

Comparisons were made of ammonium sulphate and nitrate of soda in a series of 14 experiments with roots and small grains. The heavy applications consisted of 267 lbs. of nitrate of soda per acre for roots and 178 lbs. for grain, and the light applications of 178 lbs. and 100 lbs. per acre for roots and grains, respectively. The

applications of ammonium sulphate furnished the same quantities of nitrogen. The yields obtained with the heavier applications were practically the same, while with the lighter applications of sulphate of ammonia the yield of roots was only 75 per cent of that with the nitrate of soda and of grain 67 per cent, so that on the whole nitrate of soda proved the more profitable.

Experiments with oats on a clay soil low in nitrogen indicated that calcium cyanamid, which decomposes in the soil and gives off ammonia, approximates ammonium sulphate in fertilizer value.

The average results of 9 series of experiments with oats on humus soils showed that superphosphate and Wiborgh phosphate were about equal in value, while steamed bone meal and raw bone meal were inferior to these 2 soluble phosphates.

The kernel weight of the grain crops was considerably higher on the fertilized plats than on the check plats. The average weight in 31 series of experiments of 1,000 of the kernels in the check tests was 45.22 gm. and for the plats receiving the heaviest fertilization, 47.06 gm. In 20 series of barley experiments 1,000 grains on the control plats weighed 45.01 and on the fertilized plats 46.79 gm. The lowest kernel weights were obtained with the heaviest application of phosphatic fertilizers, indicating that phosphoric acid hastens the maturity of the grain and shortens the growing period, so that a smaller amount of starch is deposited in the kernels than when a well-balanced fertilizer is applied.—F. W. WOLL.

Report of the government agrostologist and botanist for the year ending June 30, 1904, J. BURTT-DAVY (*Transvaal Dept. Agr. Ann. Rpt. 1904, pp. 261–320, pls. 21, maps 5*).—This report contains brief notes on the different field and forage crops tested during the year, and a review of observations on the stock range and native economic plants.

The author points out the wastefulness of veld burning, which is practiced all over the Transvaal for the purpose of destroying the ticks and of providing early green feed. A list of noxious weeds is given, and the more important species are discussed.

The effect of press drilling on grain crops in 1904–5, FALKE (*Deut. Landw. Presse, 32 (1905), Nos. 74, pp. 626, 627; 75, pp. 629, 630*).—Comparative and cooperative tests made with press drilling spring and winter wheat, winter rye, and winter barley resulted in every case in higher yields than those obtained from ordinary drilling, but the increase was not uniformly large.

The press-drilled plats showed a quicker and more even growth, and stronger as well as better developed plants in both fall and spring, than the plats drilled in the ordinary way. Not only did press drilling increase the yield when the precipitation was scant, but also when the rainfall was quite ample. In one test on a light soil well provided with moisture an increase of 21.9 per cent in the yield of grain was secured.

Farm grasses of the United States, W. J. SPILLMAN (*New York: Orange Judd Co.; London: Kegan Paul, Trench, Trübner & Co., Ltd., 1905, pp. XII + 248, figs. 54*).—This book is a practical treatise on the grass crop and contains directions for the seeding and management of meadows and pastures, descriptions of the best varieties of grasses and their distribution, discussions on grass seed and its impurities, a consideration of grasses for special conditions such as wet, dry, and sandy lands and alkali soils, and an outline on lawn making. Notes on commercial grades of hay and straw and rules for measuring hay in the stack are given, and the improvement of grass is discussed.

The cause of growth in barley, W. WINDISCH and K. SCHÖNEWALD (*Wchnschr. Brau., 22 (1905), No. 14; abs. in Biochem. Centbl., 4 (1905), No. 1, p. 24*).—It was found that barley sterilized by means of an alcoholic solution of corrosive sublimate germinated as readily as unsterilized barley. This work was done to test Nilson's theory that certain acid-producing bacteria found on the hulls of barley are necessary for germination.

Breeding experiments with barley, T. RAMIE (*Wchnschr. Brau.*, *22* (*1905*), *No. 13; abs. in Biochem. Centbl.*, *4* (*1905*), *No. 1, pp. 24, 25*).—Experiments were made to determine whether varieties usually grown on moist soils could be adapted to dry soils.

In order to bring about this result it is believed necessary to reduce the water requirements of the variety and to increase its capacity of using the natural water supply of the soil. The selection should be made with reference to a small surface of the plants as compared with their weight, and to a deep root system. The results obtained show that varieties may be modified to a high degree by selection in a certain direction. The quality of the grain remained practically the same, the original protein content and the size of the kernel being retained.

What influence has the chemical composition of the seed on the development, quality, and productiveness of barley, and to what extent are these characters transmitted? J. VAŇHA, O. KYAS, and J. BUKOVANSKY (*Ztschr. Landw. Versuchsw. Oesterr.*, *8* (*1905*), *No. 7, pp. 667–684*).—Pot experiments were conducted in 1904 with barleys obtained from different sources and varying in some instances in nitrogen-free extract, but containing approximately the same percentage of protein, and in other cases varying in protein but being practically the same in nitrogen-free extract. The kernels used for seed were all more than 2⅝ mm. in diameter, and the treatment of the pots was uniform in every particular throughout the experiment. Each test was repeated five times. It was observed that each pot used 32 liters of water, which corresponded to 2.461 liters per plant.

The results, which are tabulated in detail, show that where there was a high content of nitrogen-free extract, a low percentage of total protein and a high percentage of soluble protein in the seed, there was an increase in the total yield, the yield of grain, the number and weight of the stems, and the total weight of the heads and the grain. Where the nitrogen-free extract of the seed rose from 68.68 to 79.42 per cent, the total yield increased 12.76 per cent and the yield of grain 14.62 per cent, while a decrease in protein content from 15.41 to 7.17 per cent in the seed was accompanied by a gain of 13.52 per cent in total yield and of 23.86 per cent in the production of grain. This influence is accounted for by the action of the nitrogen-free extract as reserve material and the usually better developed embryo in seeds high in nitrogen-free extract. The degree of solubility of the protein is also considered a potent factor in affecting the yield.

The number of developed stems did not appear dependent upon the quantity of nitrogen-free extract in the seed but seemed to be indirectly influenced by the content of total protein. A large quantity of nitrogen-free extract in the seed showed a tendency to lengthen the stems, while the effect of the protein content, which exerted a favorable influence on the stooling of the plants, was less pronounced in this particular. With a greater stooling capacity, resulting from a low total protein and a high soluble protein content of the seed, a larger number of heads was produced, while the quantity of nitrogen-free extract apparently remained neutral in this regard. The composition of the seed did not seem to affect the proportion of hull, the composition of the endosperm, the size of the kernel, or the germination.

The authors conclude from the data obtained that nitrogen-free extract and protein content are not transmissible characters, but are controlled mainly by the quality of the soil and the supply of plant food. A difference of 10.74 per cent in nitrogen-free extract in the various seed samples was reduced to about 5 per cent in the barley produced, and the seed lowest in nitrogen-free extract showed an increase of 4 per cent while the seed highest in this constituent gave 2.29 per cent less in the product. In protein content the seed differed by 8.24 per cent, but the crops produced differed by only 1.69 per cent, and the crop from the seed richest in protein, with 15.41 per cent, stood last, with only 7.86 per cent. The seed lowest in protein showed an increase of 1.66 per cent under identical conditions of soil and growth with the other samples.

The absolute weight of the kernel, the proportion of hull, the composition of the endosperm, and the percentage of large-sized grains did not appear to be characters of regular transmission. The fineness of the hull was transmitted with much greater regularity and greater frequency than the proportion of the hull to the grain. The product from the seed samples varying in nitrogen-free extract showed a marked reduction in mealiness, but in the case of the samples differing in protein content mealiness largely increased. In every instance except one the difference in the size of the kernels in the seed samples was greatly reduced in the crops secured.

The vitality and viability of all the barleys from the various sources were much increased. Only 3 days were required for their complete sprouting and a type of Hanna barley produced on a calcareous soil gave 100 per cent in vitality and viability when 3 years old.

Varieties of barley, E. S. BEAVEN (*Reprinted from Jour. Fed. Insts. Brewing, 8 (1902), No. 5, pp. 543–600, pls. 7*).—This paper outlines the classification of the different types of barley and discusses the differences in their structure.

Experimental work with the crop, largely with reference to its malting quality, is reviewed and a list of varieties, together with data secured on the Warminster plats for several years past, is given in an appendix. Some of the work reviewed has been previously noted (E. S. R., 9, p. 436).

Experiments with corn, T. L. LYON (*Nebraska Sta. Bul. 91, pp. 35, figs. 14, map 1*).—Cooperative tests of 14 varieties of corn were made in 6 sections of the State varying in climatic conditions.

The results of these experiments, now in progress for 3 years, indicate that in the eastern part of the State Reid Yellow Dent, Hogue Yellow Dent, Nebraska White Prize, Silver Mine, Golden Cap, Golden Yellow, Golden Row, Mammoth White Pearl, and Calico have been most satisfactory, while in the middle portion Leaming, Calico, and Pride of the North, and in the western portion Pride of the North and Calico were most promising.

In studying the relation of size of ear to yield it was found that the heaviest yielding varieties produced ears of medium size, the average weight per ear of the 5 leading sorts being 0.705 lb., or considerably below the average weight per ear of all the varieties. The corn raised in the central and western part of the State produced smaller ears than the same varieties grown in the eastern part. The number of ears per bushel, as indicated by reports from experimenters, ranged from 93 to 132.

In growing 1, 2, 3, or 4 stalks per hill it was found that the yield per acre increased with the thickness of planting. The average weight of ears as well as the percentage of good ears decreased, as did also the number of ears per 100 plants and the number of suckers per 100 plants. Under favorable conditions 3 stalks per hill in rows 44 in. apart each way gave the largest yield of grain, but the conclusion drawn is that the best rate of planting varies according to the soil and season, and that therefore in Nebraska the rate of planting in the eastern part of the State should not be less than 3 kernels per hill, while in the western part on the western edge of the corn belt 2 stalks per hill are believed to be better than a larger number.

The size of ear showed a regular decrease as the rate of planting increased. The average ear from the planting containing 1 stalk per hill weighed 10.6 oz., while the average ear of the planting with 5 stalks per hill weighed only 6.6 oz. The largest number of good ears, amounting to 68 per cent, was obtained from the planting with 2 stalks per hill. In 1904 the planting of 1 stalk per hill produced 4,392 lbs. of stover per acre, the yield regularly increasing with the thickness in planting, and reaching 6,975 lbs. per acre with 5 stalks to a hill. The proportion of grain to stover was greatest with 3 stalks per hill, and this planting also produced the greatest total yield in this season.

The observations made in 1904 on the number of barren stalks as affected by planting showed that 6 per cent of the stalks planted at the rate of 1 per hill were barren,

and this rate increased with the thickness of planting and reached 27 per cent in the corn with 5 stalks per hill.

The tillering was influenced by the thickness of planting and the fertility of the soil. The number of tillers ranged from 8 per 100 plants where 4 stalks were grown in a hill, to 198 per 100 plants where only 1 stalk was grown, and on a very fertile plat 134 tillers were produced per 100 stalks, while under identical conditions on a plat of poor soil only 61 tillers per 100 were produced. In addition to these factors, there is an inherited tendency to tiller which was shown by the difference in the number of tillers produced under similar conditions by seed from different ears. When the tillers were removed from plants 20 to 25 in. high no more developed. It was also found that under favorable conditions for growth the removal of tillers reduced the yield.

Work on increasing the yields of corn by selection of plants brought out the marked differences which exist between different ears. In 1903 the yield of 82 rows planted with different ears varied from 70 to 108 bu. per acre. The 17 rows selected from this field each yielded more than 90 bu. per acre, and 6 selected ears from each one of them were planted in 1904. The season was not as good a corn year as 1903, neither was the soil as good as that used the year before, but the average yield obtained was 68.6 bu., while corn of the same variety in the same field from seed selected in the ordinary way yielded only 62 bu. per acre.

In work on the adaptation of corn to a locality, it was found that the weight of both stalk and ear was heavier in corn grown from seed secured from Iowa, but that the proportion of ear to stalk was higher in acclimated corn. The leaf area in the acclimated Nebraska corn was almost 200 sq. in. less than in the Iowa corn, but the yield of grain was greater.

Seed corn stored in a dry seed room germinated 90 per cent, as compared with 70 per cent for corn taken from the crib. Experiments on the depth of planting indicated that this should not be greater than is necessary to secure moisture for the seed.

The influence of the size of the grain and the germ of corn upon the plant, E. P. Walls (*Maryland Sta. Bul. 106, pp. 56*).—Experiments were conducted to determine the effect of the size of the kernel as shown by its weight, and of the size of the germ on the vigor of the plant.

Kernels of different weight were grown in sand containing practically no plant food in order that a difference in their growing power might be apparent. The results indicate that the heaviest grains do not necessarily have the best germinating qualities nor do they revive most quickly after moisture has been supplied succeeding a drought. When supplied with moisture, plants from the heaviest grains attained the greatest height, while plants from the highest bred seed held their vigor best under drought conditions.

It was further shown that the germinating qualities of kernels containing germs of different sizes may be equal, but that the kernels with large germs produced plants most resistant to dry weather, and that in general as the plants grow older they are likely to be larger, hardier, and more vigorous than those from smaller germed seed. It is advised to bear in mind in the selection of seed corn that there is a great difference in the individuality of plants coming from kernels from different ears, and also from kernels of the same ear; that high breeding is of more importance than weight or size of grain, and that none but large-germed kernels should be used for seed.

American cotton supply and its distribution for the year ending August 31, 1905, S. N. D. North et al. (*Bureau of the Census [U. S.] Bul. 25, pp. 15, dgms. 2*).—A summary is given showing that for the year ending August 31, 1905, the total supply of cotton was 14,455,994 bales, of which 13,318,458 bales represented the crop of 1904; 660,881 bales, the stocks on hand September 1, 1904, at ports, in

interior towns, on plantations, in mills, and in transit, and 476,655 bales of the crop of 1905 ginned to September 1.

In addition to this supply, 124,469 bales of foreign cotton were imported. The data with reference to the distribution show that 8,834,929 bales were exported; 4,278,980 bales consumed by mills, about equally divided between mills in the North and mills in the South, and that 1,305,309 bales represented the stocks on hand August 31, 1905. The domestic consumption equaled about 30 per cent and the exports about 61 per cent of the total supply for the year, leaving a surplus of about 9 per cent, including stocks in mills, at ports, in interior towns, on plantations, and in transit.

Statistical data regarding the production, commerce, and manufacture of cotton are given, and the growth of cotton production and consumption in the United States as well as the world's cotton consumption and production by countries is tabulated and discussed.

Distribution of cotton seed in 1904, H. J. WEBBER and A. J. PIETERS (*U. S. Dept. Agr., Bur. Plant Indus.* [*Circ.*], *Jan. 9, 1904, pp. 11, pls. 3*).—The distribution of cotton seed in 1904, together with the varieties distributed, is described, directions for cultivation and ginning and for growing pure seed of good quality are given, and the results desired for publication are outlined.

Thirty-seventh annual report of the Flax Supply Association for the Improvement of the Culture of Flax in Ireland (*Ann. Rpt. Flax Supply Assoc. Ireland, 37* (*1904*), *pp. 64 + 46*).—Statistics on the production, manufacture, exports, and imports of flax for different counties are given for a series of years, including 1904.

Information concerning flax grown on the Russian steppes, A. HERZOG (*Separate from Textil u. Färb. Ztg., 2* (*1904*), *No. 40, pp. 3, figs. 2*).—A microscopical and chemical study on Russian steppe-grown flax is reported.

The microscopical data include measurements of the bast cells and a comparison of anatomical data with reference to this variety and Pernauer flax. The metrical number, that is, the number of times the weight of a single dry fiber 1 km. in length is contained in 1,000 gm., is given as follows: Russian flax 2,469; Pernauer flax, fiber from the root 1,456, from the lower portion of the stem 2,198, from the middle portion 3,992, and from the upper portion 7,407.

The middle portion of the Russian flax contained 5.17 per cent of lignin, as compared with 2.36 per cent for Pernauer flax. It is pointed out that the woodiness of the fiber has an unfavorable influence on its softness, elasticity, and strength. The Russian flax was also higher in the protein content of the dry matter of the fiber.

Sets and their position in the soil as influencing the yield of potatoes, A. ANDOUARD (*Bul. Sta. Agron. Loire-Inf., 1903-4, pp. 47-50*).—Experiments made with whole and cut tubers showed that the position of the buds on the tubers and the position of the tubers in the soil did not influence the yield to any appreciable extent.

The new potato, G. BONNIER (*Fermes et Châteaux, 1* (*1905*), *No. 1, pp. 29, 30, figs. 4*).—The history of *Solanum commersonii* is reviewed and the work carried on for the improvement of the plant discussed. The aerial and underground tubers produced by the plant are described and figured. The experimental work here referred to has been previously noted (E. S. R., 17, p. 244).

Rye and some of its uses, J. M. JAMISON (*Breeder's Gaz., 48* (*1905*), *No. 14, pp. 629, 630*).—A method of growing rye and clover is described.

The rye is fall sown and pastured during the winter and in the spring the land is seeded at the rate of 1 pk. of clover seed per acre. The rye is allowed to ripen and is then harvested by turning sheep and hogs into the field. This results in a heavy volunteer crop mixed with the clover for fall pasture. The following season the clover

and the ripened volunteer crop is cut for hay. The rye straw in the clover hay has the advantage of making the stack much more capable of shedding the rain than the pure clover.

The sugar industry, and particularly the beet-sugar industry in the United States, P. DE VILMORIN (*De l'industrie du sucre et en particulier du sucre de betteraves aux États-Unis. Compiègne: H. Lefebvre, 1905, pp. 16, map 1*).—A discussion of the beet-sugar industry in the United States. The author concludes from his observations that the average yield of beets in this country is very low and the sugar content medium, except in the States where irrigation is practiced.

Sugar cane, F. S. EARLE (*Estac. Cent. Agron. Cuba Bul. 2, pp. 47, pls. 2, figs. 17*).—This bulletin is a general treatise on sugar-cane culture in Cuba, describing the various cane soils of the island, outlining different systems of growing the crop, and reporting the results of several culture and fertilizer tests.

In the prevailing system of culture the cane is planted in hills about 3 ft. apart, with a distance of 4.5 to 5 ft. between the rows The soil is prepared and cultivated the first season, but no further tillage is given. The Zayas system requires wider planting, usually 9 by 12 ft., and giving continued cultivation throughout the year with modern implements Under this system barnyard manure is used, but no commercial fertilizers are applied, and in harvesting all canes not sufficiently mature for cutting are allowed to remain for later ripening.

At the station the Zayas system failed to produce a maximum first crop as compared with the common system and the cost of production was greater. The saving of immature canes was also unsatisfactory It was further found that the cane grown by the common system ripened earlier and during November averaged about 1 per cent more of sucrose than the cane grown by the Zayas system. By the middle of December the 2 lots were practically identical, and by the end of February the Zayas cane contained 1.4 per cent more sucrose.

Results obtained by cane growers at other points also show that the Zayas system does not always give as good yields the first year as the common system. Some consider this due to injury to the roots caused by the continued cultivation. In one test the cost of soil preparation, planting, and cultivation according to this system amounted to $527.86 per caballería (about 33⅓ acres). Cane grown on red land was slightly better in quality than a crop from black land.

A new variety of spelt, P. H. STOLL (*Deut. Landw. Presse, 32 (1905), No. 59, pp. 506, 507, fig. 1*).—A new variety obtained by crossing Rivett Bearded wheat and Red Tyrolean spelt, and named Stoll Early Giant, is described.

[Bibliography of tobacco] (*Mo. Rec. Sci. Lit., 29 (1905), No. 6, pp. 186, 187*).—A list of 25 works on the culture, history, and other matters pertaining to tobacco, published from 1733 to 1897.

Spring vetch and winter vetch, E. RABATÉ (*Jour. Agr. Prat., n. ser., 10 (1905), No. 36, pp. 304–306, figs. 5*).—The 2 kinds of vetches are described and directions for their culture are given. A cultural test showed that the seeds from the same pod and the same plant are uniform in color, and it is concluded from this result that the plants are, as a rule, self-fertilized. Directions are given for the determination of the seed of the 2 species of vetches.

Experiments with winter wheat, C. G. WILLIAMS (*Ohio Sta. Bul. 165, pp. 35–65, figs. 11*).—The description of varieties grown the past 2 seasons and the comparative yields and other data of varieties tested from 6 to 12 years are presented in tabular form. The yields and protein content of the different varieties for the years 1901 to 1904, inclusive, are also given in tables.

Based on the yields of grain alone, the best 10 varieties in the order of their rank were Gypsy, Mealy, Early Ripe, Poole, Nigger, Perfection, Mediterranean, Valley, Currell Prolific, and Dawson Golden Chaff; and based on the weight per bushel, the

10 varieties testing highest were Hickman, Red Wonder, Fulcaster, Gypsy, Valley, Deitz, Currell Prolific, Perfection, Nigger, and Lebanon. Velvet Chaff, Lehigh, Sibley New Golden, Red Wonder, Lebanon, New Columbia, Fultzo-Mediterranean, Deitz, and Buda Pesth, in the order given, ranked highest in percentage of protein.

It was observed that a high temperature for the month preceding harvest quite uniformly decreased the yield and weight per bushel, but owing to a reduced starch content, increased the percentage of protein. Anything hindering the normal development of the kernel, as plant diseases or insect enemies, also increases the percentage of protein, but this increase due to these various causes is not desirable because the protein is found more largely in the bran and other products than in the flour. A high protein content in normally developed wheat is desirable and should be sought for as a variety characteristic.

Ranking the varieties on a basis of 60 points for yield, 25 for weight per bushel, and 15 for protein content, the following 10 scored highest: Gypsy, Early Ripe, Nigger, Poole, Mealy, Currell Prolific, Valley, Red Wonder, Democrat, and Fulcaster. The first 4 of these varieties are considered as quite generally satisfactory for the entire State. Mealy is described as doing well on rather thin upland, being quite disappointing on rich soils and bottom lands, and giving in general a good yield but having a greater tendency to shrivel than many varieties.

The results of 11 years' work indicate that on the somewhat worn lands of the State from 8 to 10 pk. of seed wheat per acre will give better yields than a smaller quantity. In normal seasons seeding September 20 to 22 has been most satisfactory, with seeding September 15 standing next. In only 3 seasons out of 13 did first grade seed as graded by a fanning mill give larger yields than seed from which the small and light grains had not been so removed. The removal of the shrunken, broken, and extremely small grains is advised, for the purpose of securing a more uniform seeding and a greater vitality to resist unfavorable seasons.

The selection of large as compared with small heads indicated that permanent improvement must be based upon the selection of plants as a whole, and not upon certain parts. The excellence of the plant must be due to hereditary influences rather than environment. Methods of wheat breeding by selection are given.

The annual report of the seed control station at Örebro, 1904, J. WIDÉN (*Örebro Kem. Stat. och Frökontrollanst. Årsber. 1904, pp. 27–49*).—The average results of purity and germination tests of a list of grass and field crop seeds are given in tables.

HORTICULTURE.

Report of the fruit experiment stations of Ontario, 1904, L. WOOLVERTON ET AL. (*Ann. Rpt. Fruit Expt. Stas. Ontario, 11 (1904), pp. 144, figs. 88*).—Original descriptions and half-tone illustrations are given, in continuation of previous work (E. S. R., 16, p. 264), of 13 varieties of apples grown in Ontario, 4 of blackberries, 4 of grapes, 14 of peaches, 9 of pears, 7 of plums, and 1 of quinces, with an account of the work done during the year at the various experimental fruit stations and general notes by the experimenters on the various fruits grown. In addition a list of fruits recommended for planting in various parts of the Province of Ontario is given, together with the papers presented at a meeting of the association.

British fruit growing, S. PICKERING (*Nature [London], 72 (1905), No. 1869, pp. 396, 397*).—A discussion of fruit culture in relation to meteorology, more especially frosts, with some data on the blooming period of a large number of varieties of apples in England.

It was noted at the Woburn Experimental Farm that there was an apparent connection between earliness of blooming and the earliness of ripening of the fruit. Thus, 37 early varieties were in bloom on an average, May 4.7; 40 mid-season varieties, May 6.3; and 40 late varieties, May 8.

British fruit growing, A. O. WALKER (*Nature [London], 72 (1905), No. 1867, pp. 342, 343*).—The author calls attention to the desirability of experiments being made to determine the effect of locality and climate in orchard planting. Some meteorological data are given which show the variations that occur in the same latitude at various elevations and exposures.

Fruit culture in Argentina, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 27 (1905), No. 2, pp. 192–210, figs. 6, map 1*).—An account of the climatic and soil conditions of Argentina and the production, culture, and export of fruit.

From recent statistics it appears that there are about 200,000 acres planted with fruit trees and 120,000 acres planted with vines. Of the different fruits grown, exclusive of grapes, peaches constitute 40 per cent, citrus fruits 20 per cent, figs and apples 10 per cent each, pears, quinces, and plums 5 per cent each, cherries and all other kinds of fruits, including nuts, 5 per cent. It is thus seen that the peach is the principal fruit of the country. Plums also do especially well, but apples and pears are of minor importance.

Methods of marketing fruit, with descriptions of the packages used, are given, with an account of fruit exhibitions, etc.

The fruit industry at Barbados, J. R. BOVELL (*West Indian Bul., 6 (1905), No. 2, pp. 99–108*).—An account of the efforts that are being made to establish a fruit industry between Barbados and the United Kingdom.

Bananas, mangoes, avocado pears, pomelos, and golden apples have been shipped experimentally, and the details are given of these shipments and of the prices received for the different fruits. Bananas have been very successfully shipped except in the hottest weather, and it appears that when these can be delivered in good condition in England, there is no crop at present grown in Barbados which is likely to be so profitable.

Mangoes stand next in importance, and while some shipments arrived in splendid condition, others have rotted. As soon as the right temperatures for these and avocado pears can be ascertained it is thought probable that shipments of these fruits will prove quite remunerative.

Influence of the scion on stock, A. JULIE (*Prog. Agr. et Vit (Ed. l'Est), 26 (1905), No. 40, pp. 391, 392*).—The author grafted the variety Aramon Rupestris Ganzin with Gamay d'Arcenant. Some time later a shoot came out 6 in. below the graft which had leaves like the Vinifera variety with much larger and earlier fruit than the Rupestris.

Sod-grown fruit, H. M. STRINGFELLOW (*Texas Farm and Ranch, 24 (1905), No. 33, pp. 10, 11*).—The author calls attention to the especially good keeping qualities of peaches grown in sod orchards.

He sent peaches from Texas to Richmond, Va., Rochester, N. Y., and Harrisburg, Pa., where they arrived in perfect condition without refrigeration. One shipment to Rochester, N. Y., was returned to Texas without ice. The good condition of these peaches upon reaching Texas is shown in an illustration in *Texas Farm and Ranch*, 24 (1905), No. 34, p. 10. Pears grown on sod land have also been shipped by the author in carload lots to Chicago without refrigeration and arrived there in perfect condition. He argues that much of the poor keeping quality of fruits is due to cultivation of orchards.

Stringfellow tree culture, J. C. WHITTEN (*Rural New Yorker, 64 (1905), No. 2894, p. 535*).—The author reports that fruit trees root and top pruned according to the Stringfellow method have not succeeded as well at the Missouri station as trees planted and pruned in the ordinary manner.

Peaches have been less injured by the Stringfellow method of pruning than apples, and where the trees pruned according to the Stringfellow method have lived over the first summer they have invariably developed into good trees. The author notes that some commercial growers throughout the State report excellent success in

planting and pruning according to the Stringfellow method, and others much better results by the usual method.

It is believed that the method of stub-root pruning and cutting the stock back to 12 to 18 in., according to the plan advocated by Mr. Stringfellow, has been of great service in showing that it is not necessary to retain anything like the large quantity of fibrous roots which was formerly supposed. Many large growers are now cutting back the roots of trees much more severely at planting time than heretofore.

Cause of the presence of abnormal quantities of starch in bruised apples, G. WARCOLLIER (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 8, pp. 405–408*).—When apples are bruised before ripening the starch in the bruised zone is not converted into sugar during the ripening process. The author investigated the cause of this and believes that he has proved it to be due to the action of tannin on the amylase, which prevents this diastase from transforming the starch into fermentable sugar.

The packing of peaches, F. CHARMEUX (*Jardin, 19* (*1905*), *No. 446, pp. 280, 281, figs. 5*).—Illustrations showing the packages and methods of packing peaches in the south and west of France and in Spain are given.

How fruit should be packed (*Canad. Hort., 28* (*1905*), *No. 10, pp. 375–377, fig. 1*).—A discussion is given of Pacific coast practices in packing fruit and of their application to Canadian fruit.

Cold storage for fruits and vegetables, R. STETEFELD (*Gartenflora, 54* (*1905*), *No. 9, pp. 231–245*).—A lecture on this subject in which the results of experimental work in the United States and Europe are briefly reviewed and a table given showing the best temperatures for storing a large number of fruits and vegetables and the kind of packages in which they are commonly stored in Europe.

Causes of citrus fruit decay, G. H. POWELL (*Cal. Cult., 24* (*1905*), *No. 15, pp. 344, 345*).—A preliminary account is given of the investigations which are being carried on by the Bureau of Plant Industry of this Department in cooperation with the fruit interests of California, for the control of losses from disease which occur in the handling of California citrus fruits during transportation and marketing.

Thus far it has been found that mechanical injuries to the fruit are the principal causes of decay. When the skin of an orange or lemon is broken blue mold finds access to the wound and under favorable moisture and temperature conditions develops, resulting in the decay of the fruit. An examination of hundreds of boxes in different representative orange sections of the State indicate that from 15 to 20 per cent of all fruit is made susceptible to rot by puncturing or shaving the skin with clippers when the fruit is picked.

A table made up from 9 representative experiments with oranges carefully handled in comparison with clipper-cut oranges is given, which shows that in a given time in moist air and a temperature of 70° F. the decay of fruits free from cuts averaged about 2.5 per cent, while the decay in cut fruits averaged 36.9 per cent. A wide variation was found in the percentage of decay of fruits picked by different pickers, the percentage ranging from 7 to 72 per cent. Fruits cut with long stems were also found a source of injury, as the stems puncture other fruits and thus permit the entrance of disease spores. The injury from this source, however, is estimated to be about 1 in 25 in comparison with the losses from clipper cutting.

With the present method of handling fruit in packing houses it is believed that probably not 2 per cent of the clipper-cut fruit is detected and thrown out by the graders as it passes through the machinery. A large amount of fruit has been examined in bins and boxes already packed which showed that the clipper-cut fruit from such bins and packed boxes ranged from 10 to 37 per cent.

The brush may be another source of injury to the fruit. Whether it injures the fruit mechanically or whether it inoculates the fruit already injured has not been definitely determined. It has been found, however, that decay in the same lot of

fruit may be raised or lowered from 10 to 30 per cent or more by closing or opening the same brush. The brush is always full of mold spores, and if the fruit has been clipper cut, or injured in any other way, the brush is likely to deposit disease spores in these bruised places, which will eventually develop decay.

Experiments are under way to determine the effect of delay in cooling fruit before shipping. The experiments thus far indicate that the orange can be placed in any market in the country in prime condition if it is shipped quickly after picking in a cold condition. The author is not so certain about the results where the fruit stands in a packing house several days before packing and cooling. The results of several shipments to New York indicate that the cut fruit can be shipped with not more than 5 per cent of decay if the fruit is loaded in the refrigerator car quickly after the injury has been made. If, however, the oranges are delayed several days in the packing house it is probable that no degree of cooling that could be maintained by a refrigerator car could wholly eliminate the trouble.

An experiment was made in which oranges were stored at a temperature of 32° F., immediately after picking, and after 27, 52, and 94 hours' delay, respectively. The fruit had been inoculated with the blue mold. The record of decay made 10 days after the storage in each case is as follows: Immediate storage, no decay; 27 hours delay, no decay; 52 hours delay, 15.5 per cent decay; 94 hours delay, 75.5 per cent decay. "From these data and the experience in fruit storage we have no hesitation in saying that oranges ought to be packed in the quickest possible time where they are to be shipped in warm weather under ice."

Attention is called to the decay of fruits after they have been in cold storage. Cold storage simply retards decay, and if the fruits have been inoculated with disease spores it is likely they will decay after they have been removed from the cold-storage room. The fault, however, is not with the cold storage but with the previous condition of the fruit. The gist of this same article also appears in *Pacific Rural Press* (69 (1905), No. 17, pp. 260, 261).

The newer strawberries, W. J. GREEN and F. H. BALLOU (*Ohio Sta. Bul. 166, pp. 20.*)—Descriptive notes on 50 of the newer varieties of strawberries grown at the station during the year, with a tabular account of the behavior of many of the older sorts as well.

The authors deprecate the use of the term "pedigree" strawberry plants, since those thus called are not pedigreed plants at all, while really pedigreed strawberry plants have no value above those without a pedigree. The word "pedigree" is a misnomer when applied to strawberry plants, tends to confusion in the minds of many, and leads to deception. In 1903 the "pedigreed" plants of 7 varieties were compared with plants of the same varieties obtained from a reliable grower. Five of the 7 varieties gave better yields from the common than from the so-called "pedigreed" plants.

The experiment was repeated in 1905 with very similar results.

Strawberry culture in Cuba, H. J. SQUIERS (*Mo. Consular Rpts.* [*U. S.*], *1905, No. 297, pp. 178, 179*).—Notes are given on the methods of strawberry culture followed by W. P. Ladd, an American living in Santiago de las Vegas. Chocolate land has been found better than red land for this plant as the latter appears to be too porous and dries out easily. From about three-fourths of an acre $1,000 worth of strawberries were sold, giving a net profit of $597.

Small fruits, J. F. NICHOLSON (*Oklahoma Sta. Bul. 69, pp. 20*).—Popular directions based on work at the station are given for the culture of blackberries, dewberries, raspberries, strawberries, gooseberries, and currants, with accounts of the diseases and insects affecting these different fruits, and suggestions as to means of control. Of all small fruits, blackberries and dewberries succeed the best. Raspberries are not well adapted to the climate of Oklahoma, and gooseberries and currants do not succeed.

Small fruits and grapes, C. A. KEFFER (*Tennessee Sta. Bul., Vol. XVIII, No. 2, pp. 13–21, figs. 7*).—Popular directions are given for the culture of strawberries, raspberries, blackberries, and grapes, based on the results of experimental work at the station.

The two most frost-resistant varieties of strawberries out of 50 tested appear to be Michel Early and Carrie. Excelsior, Klondike, Pride of Cumberland, Clyde, Haverland, and Bubach No. 5 were all badly damaged by frost.

Especially good results have been obtained with raspberries by mulching. The mulch as applied was 18 in. deep and by spring had settled down to about 10 in. deep, and extended a foot or more on either side of the row. Raspberries thus treated were much less injured by the cold than unmulched vines, and made over twice the growth of the unmulched plants during the following season. The plants mulched with field bean straw made a better growth than those mulched with lawn rakings.

With grapes, it was noticed that the severe frost which destroyed all the new shoots in the vineyard after they were 4 to 10 in. long resulted in the production of a large amount of "blind" shoots—that is, shoots which bore no fruit. The amount of fruitful and blind wood on a number of vines of 6 varieties counted is tabulated.

Layering grafted vines; grafting cuttings by approach, F. CHARMEUX (*Jardin, 19 (1905), No. 436, pp. 120, 121, figs. 4*).—Layered shoots of European varieties of grapes throw out roots which are not resistant to phylloxera.

The method of Petit-Roch of grafting these layers by approach on either a rooted or nonrooted phylloxera resistant cutting is described. In the case of nonrooted cuttings after the graft is made the lower portion of the cutting is placed in a bottle of water. With rooted cuttings the graft is tied with raffia and otherwise treated like an ordinary layered vine, being well mounded up with earth.

The packing of hothouse grapes, F. CHARMEUX (*Jardin, 19 (1905), No. 445, pp. 260, 261, figs. 6*).—The packages used for packing hothouse grapes and methods of packing are illustrated and described.

Proceedings of the Society for Horticultural Science (*Proc. Soc. Hort. Sci., 1903–4, pp. 108*).—This publication of the society contains the papers presented before it at its two annual meetings in 1903 and 1904, a summary of which has been noted elsewhere (E. S. R., 15, p. 538; 16, p. 729). In addition it contains the constitution of the society, a list of members, officers, etc.

Okra: Its culture and uses, W. R. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 232, pp. 16, figs. 8*).—The purpose of this bulletin is to encourage a more general distribution and use of okra or gumbo (*Hibiscus esculentus*) by giving cultural hints, descriptions of a few of the leading varieties, and directions as to cooking.

Hop sprouts as vegetables, G. W. ROOSEVELT (*Mo. Consular Rpts. [U. S.], 1905, No. 297, p. 59*).—The author states that young hop sprouts are extensively used in Brussels as early spring vegetables. The most succulent sprouts are those taken from the foot of the hop plant which has been covered with earth during the winter months.

Pickles—how to make them, R. BLANCHE MADDOCK (*Canad. Hort., 28 (1905), No. 10, pp. 379–381*).—Directions are given for making cucumber, mustard, and green tomato pickles, pickled fruits, and for keeping ripe tomatoes over winter.

Ginseng in China, F. D. CLOUD (*Mo. Consular Rpts. [U. S.], 1905, No. 297, pp. 135–137*).—Brief descriptions are given of 5 sorts of ginseng found in Chinese markets, with the statement that American ginseng is liked in some Chinese cities, while in others the Chinese do not care for it and scarcely buy it at all.

Culture of mushroom spawn from spores, J. STEINERT (*Wiener Illus. Gart. Ztg., 30 (1905), No. 7, pp. 230–232*).—The author describes a successful method adopted by himself for growing mushroom spawn and gives the results of trials in growing mushrooms from such spawn.

Suggestions about seed growing, J. JEANNIN, Jr. (*Rural New Yorker, 64* (*1905*), *No. 2906, p. 725*).—Suggestions are given for selecting seed of beans, corn, cucumbers, eggplant, lettuce, melons, squashes, peas, radishes, spinach, tomatoes, celery, cabbage, and onions.

Culture and distillation of perfumery plants in Java, P. SERRE (*Agr. Prat. Pays Chauds, 5* (*1905*), *No. 30, pp. 255–258*).—This article deals primarily with the distillation of Citronella from *Andropogon citratus* or lemon grass.

Tea culture in Japan, PHIPPS (*Diplo. and Cons. Rpts.* [*London*], *Misc. Ser., 1905, No. 637, pp. 13*).—A detailed account is given of Japanese methods of curing tea, with statistics of the principal tea-producing prefectures and of the amount and value of tea produced during the year 1903. The total yield was 55,588,030 lbs.

Cultivation of tea in the Caucasus, P. STEVENS (*Diplo. and Cons. Rpts.* [*London*], *Misc. Ser., 1905, No. 628, pp. 5*).—An account of the culture of tea along the Black Sea near Batoum. The tea crop of 1903 in this region was 38,700 lbs.

Yerba-mate culture in New Germany, Paraguay, R. VON FISCHER (*Tropenpflanzer, 9* (*1905*), *No. 9, pp. 495–505*).—An account of the culture of this tea plant in Paraguay with considerable data on cost of growing a plantation, yield, etc.

Chart of flowering trees and shrubs, F. DUNCAN (*Country Calendar, 1* (*1905*), *No. 6, pp. 564–566*).—A chart is given, showing the common and botanical name, time of blossoming, color of blooms, soil, and culture requirements of a large number of ornamental trees and shrubs, arranged with reference to spring, summer, and autumn blooming. Similar data are given for trees and shrubs having brightly-colored bark for winter effect and trees and shrubs for winter fruiting effects.

Tree subirrigation along streets and parks, C. ERWIEN (*Wiener Illus. Gart. Ztg., 30* (*1905*), *No. 2, pp. 61–66, figs. 3*).—A method of watering trees along streets by means of subirrigation is described.

Iron pipes are laid 10 to 16 in. beneath the level of the street and 3 to 6 ft. from the trees. Water escapes from these through openings on the upper side. The pipes are laid in gravel with a brick over the top to prevent the entrance of dirt. The pipes must be so arranged that all the water can be withdrawn from them during the winter months to prevent freezing. Illustrations are given of the appearance of trees along streets thus watered and of other trees surface watered, which show the much greater benefit derived from subirrigation.

The book of garden furniture, C. THONGER (*London and New York: John Lane, 1903, pp. XII+100, pls. 24, figs. 11*).—In this popular book such subjects are considered as garden seats, summerhouses, archways and trellises, pergolas, gates, fences, sundials and statuary, bridges, fountains, urns, vases, etc. This is Volume 22 of the Handbooks of Practical Gardening, edited by H. Roberts.

The book of the carnation, R. P. BROTHERSTON (*London and New York: John Lane, 1904, pp. XII+95, pls. 17*).—This is a popular book on this subject, giving the history of the carnation and directions for the culture of carnations in the garden, in pots, and for exhibition. The book contains a chapter on raising new carnations by M. R. Smith. This is Volume 23 of the series of Handbooks of Practical Gardening, edited by H. Roberts.

Grafting the carnation on Saponaria, G. POIRAULT (*Jardin, 19* (*1905*), *No. 441, p. 201*).—The author grafted carnations on Saponaria for the purpose of preventing the disease caused by *Fusarium dianthi*, and describes his method of work.

Two-year-old carnation plants grown in pots are used for root grafting, preferably by the English method. Saponaria grown either in pots or out-of-doors may be used. After the graft has been made the plants are repotted and placed under bell jars in a hotbed, where they remain for 3 or 4 weeks, at the end of which time they are gradually hardened off.

Plants thus grafted flowered in December. They ceased flowering in January and February, during the resting period of the stock, and began flowering again in Feb-

ruary and March. The flowers of the grafted plants have been as large and as beautiful as those of carnations on their own roots. In this work observations will be made to determine whether the immunity acquired by grafting on Saponaria is inherited in the seedlings.

All the species of phlox worth cultivating, L. BARRON (*Gard. Mag.* [*N. Y.*], *2* (*1905*), *No. 4, pp. 167–169, figs. 10*).—The different species of phlox most commonly cultivated are described and a key given for their identification. Methods of cultivating each of the different species are included.

The incomparable Japanese lilies, W. MILLER (*Gard. Mag.* [*N. Y.*], *2* (*1905*), *No. 4, pp. 174–177, figs. 8*).—The various species of Japanese lilies that can be cultivated in this country are described, cultural methods suggested, and a key given for their identification.

A planting chart of bulbs and perennials, R. CAMERON (*Country Calendar, 1* (*1905*), *No. 6, pp. 562, 563*).—A chart is given showing in tabular form the common and botanical names, color of bloom, soil, and cultural requirements of bulbs and of herbaceous perennials blooming at different periods of the season from May to October.

Experimental researches on the seed of orchids, A. MAUMENÉ (*Jardin, 19* (*1905*), *No. 438, pp. 156, 157, figs. 4*).—This is largely a review of the work of N. Bernard, who showed that the presence of endophytous fungi in the embryo of the seed of orchids is an essential condition to their germination.

The hybridization of Odontoglossum, L. DUVAL (*Jardin, 19* (*1905*), *No. 443, pp. 238, 239*).—Methods of hybridization are described and some results secured noted.

FORESTRY.

Influence of the origin of seed on the character of forest growth, A. ENGLER (*Mitt. Schweiz. Centralanst. Forstl. Versuchsw., 8* (*1905*), *No. 2, pp. IV + 81–236, pls. 13, dgms. 2*).—Different kinds of forest seeds were gathered in localities of varying altitudes above sea level, and studied as regards weight, ability to germinate, and character of seedlings produced. The details are given in extended tables and discussed at length.

Some of the more important conclusions relative to the different kinds of seed are as follows: The weight of spruce seeds and their ability to germinate decrease in general with the height above sea level at which they are harvested. There is no decided influence, however, up to 1,200 to 1,400 meters. Seeds from high mountainous districts do not germinate with as great energy as seed from lowlands and lose their ability to germinate sooner.

The growth characteristics of highland and lowland spruce are inherited by the seedlings, even when grown under different climatic conditions. Spruce grown from lowland seed decreases in height growth with the distance above sea level and at a more rapid rate than spruce grown from highland seed. High Alpine spruce is characterized by a relatively large root development as compared with lowland spruce. Seed from green cones produces the same kind of seedlings as seed from red cones grown in the same locality. Large seed produces larger, heavier seedlings than small seed.

Seed from Alpine regions when grown in lowlands produce trees which start into growth earlier in the spring, do not grow so high, and stop growing earlier each season than trees grown from lowland seed. Seedling spruces from highland seed are characterized by closer and shorter needles than those of lowland seedlings. The structure of the needles to prevent drying out is also better. They suffer less in high situations from early frosts, from destruction of the chlorophyll by too strong insolation, and from breaking down by snow.

For restocking mountainous regions with spruce seedlings no seed grown at an altitude of 1,500 to 1,800 meters above sea level should be used. Seeds from ill-formed trees produce as good seedlings as from well-formed trees. Seeds from an especially bushy spruce produced seedlings, 67 per cent of which were like the mother tree.

In experiments with silver fir (*Abies pectinata*) all seed gathered at 1,300 to 1,400 meters above sea level proved of like character as regards weight, ability to germinate, etc.

Experiments with European larch (*Larix europæa*) showed, as with spruce, that two climatic races can be distinguished in Alpine districts. Up to 1,700 meters above sea level a quick growing kind obtains, while above this height a much slower growing variety is found, and these characteristics are inherited by the seedlings. Seed gathered up to about 1,700 meters possesses like weight and ability to germinate. Seed gathered in very high districts possesses less ability to germinate. Seed selected from trees stunted because of unsuitable soil conditions may transmit these characteristics. Therefore, in practice, only seed from well-formed trees should be gathered.

With the sycamore maple (*Acer pseudoplatanus*) also the best results are secured by planting the seed harvested in the same or like locality as regards altitude and climate.

On the whole the experiments indicate very clearly that in forestry practice the best seeds are those which are grown in the locality where they are to be planted.

A working plan for forest lands in Berkeley County, South Carolina, C. S. Chapman (*U. S. Dept. Agr., Bur. Forestry Bul. 56, pp. 62, pls. 4, map 1*).—Part 1 of this bulletin contains a general description of a tract of 44,943 acres of timber land owned by the E. P. Burton Lumber Company, with volume and yield tables, and a general account of lumbering, marketing, and transportation and grazing. Sylvical descriptions are also given of the most important trees, including loblolly pine, shortleaf pine, cypress, red and black gum, etc.

Part 2 discusses the management of this tract on the basis of these data. The investigations led to the conclusion that the prevailing species (loblolly pine), method of logging, and the location of the tract are all adapted to make the pine lands permanently valuable, if treated in such way as to insure future crops of timber. A working plan prepared with this end in view is given.

Reafforestation in the Deccan and other dry districts, H. F. Arbuthnot (*Indian Forester, 31 (1905), No. 4, pp. 205–207*).—The average rainfall of the district under discussion is under 20 in. annually, all of which falls between the second week of June and the middle or end of October. During the 7 months in which no rain falls trees planted in the ordinary way must be watered.

The author states that the ryots have developed a system of planting without irrigation which is very successful. They make ridges 2 ft. high by scraping up the surface of the soil. On the top of these ridges Neem (*Melia azadirachta*) hedges are planted. In 1 hedge 2 years old saplings were 7 to 8 ft. high and 8 to 19 in. in girth. The author planted Acha (*Hardwickia binata*) seed in the same manner and found that it made a much more satisfactory growth than when planted in an 18 in. cube pit and regularly watered from July 1.

The seasons and growth, Heck (*Forstw. Centbl., 27 (1905), No. 6, pp. 293–300*).—Some data are given on the growth of beech and ash during different periods of the year, and also on the relation of temperature and rainfall to growth during the different months.

In 1904, 57.6 per cent of the growth of ash was made by May, 32.9 per cent during June, and 9.5 per cent during July and the remainder of the summer and autumn months. With beech about 40 per cent of the growth was completed by June 1, 40 per cent more during June, and 20 per cent during the remainder of the year.

Annual rings of tree growth, E. E. BOGUE (*Mo. Weather Rev., 33 (1905), No. 6, pp. 250, 251*).—The author reports an investigation of the seasonal and annual rapidity of growth of trees at Stillwater, Okla., between October 1, 1898, and September, 1901.

Twenty-seven trees were under observation during the entire time. Among them were maples and various fruit trees, such as the plum, peach, cherry, apple, quince, pear, Russian mulberry, and apricot. The increase in girth is shown in tabular form, together with the rainfall by months, from which it appears that the month of maximum rainfall was also the month of maximum growth. It is concluded that in general there is a direct relation between precipitation and tree growth.

The use of commercial fertilizers in forestry, F. GIERSBERG (*Forstw. Centbl., 27 (1905), No. 1, pp. 31–38*).—An account of forestry experiments in Belgium with commercial fertilizers, a more detailed record of which is to appear later in pamphlet form. On poor soils the use of fertilizers has been found especially helpful. A number of examples are cited, one of which will serve to show the general trend of all.

A forest area in 1893 was fertilized with 2,000 kg. of Thomas slag and 1,000 kg. of kainit per hectare and planted. Nine years later the trees in this area had an average height of 3.1 meters, while in an area alongside which had been 10 years planted the average height was but 1.8 meters. The results of fertilizer experiments throughout Belgium the past 15 years have thoroughly established the use of commercial fertilizers in forestry work, results being obtained in 20 years with fertilizers which are hardly obtained in 30 years without their use.

Besides the more rapid growth of the trees on the fertilized areas they appear much less subject to attacks from insects and diseases than trees not fertilized, and in transplanting, even in unfavorable weather, they are much more likely fo live.

Report of the conservator of forests, C. E. LEGAT (*Transvaal Dept. Agr. Ann. Rpt. 1904, pp. 321–344, pl. 1*).—An outline is given of the work of the year, including an account of the government nurseries in different localities, timber imported into the Transvaal, seed distribution, etc.

The natural evergreen forest of the Transvaal does not exceed in area 150,000 acres. All but the most inaccessible portions of this forest has been heavily worked in past years. A list is given of the species actually found in the indigenous forests up to date.

A sylvicultural study of larch, A. CIESLAR (*Separate from Zentbl. Gesam. Forstw., 30 (1904), No. 1, pp. 27*).—An account of the natural geographical distribution of the Alpine and Siberian larches, of the larch canker, and of the culture of larch in mixed forests.

As showing the injurious effect of shade on the devolopment of larch seedlings, the author notes an experiment in which seedlings of larch, spruce, and black and white pine were grown under lath shade and without shade. Counting the volume growth of the larch seedlings in the open 100, the growth of the spruce under shade was 54, black pine 27, white pine 19, and larch 13. When spruce and larch are grown together the spruce develops slowly for a number of years, while the larch shoots up rapidly. So long as the larch is dominant the two thrive together, but in from 20 to 40 years, when the spruce overtakes the larch, the latter soon succumbs.

Much better results are obtained as regards larch when it is grown with white pine, since the white pine does not become dominant until the larch has reached merchantable size. The larch also does well with red beech.

Treatment of Scotch pine in the vicinity of Paris, L. PARDÉ (*Rev. Eaux et Forêt, 44 (1905), Nos. 5, pp. 129–143; 6, pp. 161–173*).—A discussion of the common method of growing Scotch pine (*Pinus sylvestris*) in the region about Paris.

Fifty to 60 year rotations are advocated for this tree around Paris instead of longer periods. Artificial regeneration is perhaps more satisfactory, on the whole, than natural restocking. Seed from trees 50 years old was found as valuable as seed from trees 85 years old from the standpoint of percentage of germination.

Note on the germination of teak and other seeds, R. S. PEARSON (*Indian Forester, 31 (1905), No. 3, pp. 168-171*).—Of several different methods tested for the germination of teak seeds the most successful was that in which the seed was stratified about 1 in. thick in a pit 10 ft. square and 18 in. to 2 ft. deep, with alternate layers of earth of the same thickness.

After the pit was thus filled level with the ground it was flooded with water every other day 5 times. The whole mass was then thoroughly mixed and again watered, on alternate days until the seed showed signs of germination. Suggestions are given for germinating the seeds of a number of other Indian trees.

Girdling of miscellaneous trees in sal forests, F. F. R. CHANNER (*Indian Forester, 31 (1905), No. 7, pp. 376-378*).—Of 27 species of trees girdled, it was found that 12 do not die when girdled, 5 die when well girdled, while further information is required before stating positively whether the remainder do or do not die as a result of girdling.

Some facts about gutta-percha, A. M. B. MURDOCK (*Indian Forester, 31 (1905); No. 6, pp. 309-320, pls. 4*).—An account of the species and distribution of gutta-percha in the Federated Malay States, measures observed for the protection of the tree, methods of extracting latex, manufacture, adulteration, and the properties of gutta-percha.

Coagulation of the latex of Ficus elastica, E. S. CARR (*Indian Forester, 31 (1905), No. 6, pp. 335-337*).—The methods observed in tapping *Ficus elastica* and preparing the rubber therefrom in the government plantations of Charduar and Kulsi, in Assam, are noted.

In tapping, the cuts are made at nearly right angles to the line of growth of the stem, aerial root, or branch at about 1.5 ft. apart around half of the portion tapped. The cut is made only to the cambium layer. The overflow from the cuts is allowed to fall on mats made of thin strips of bamboo woven together. This drip rubber forms a kind of a skin over the mat and has a whitish appearance, whereas that which remains in the cuts has a reddish-brown color. The former, after drying, brings a slightly lower price in the market than that collected in the cuts.

DISEASES OF PLANTS.

The fourteenth annual report of the special committee for plant protection, 1904, P. SORAUER, L. REH, ET AL. (*Arb. Deut. Landw. Gesell., 1905, No. 107, pp. LX+294*).—A report is given of the observations of the different members of the special committee on the investigation of plant diseases and plant protection, the notes being arranged topically according to host plants.

The principal groupings are diseases of cereals, beets, potatoes, leguminous plants, vegetables, and fruit trees, and vine diseases. In addition to descriptions of the fungi attacking these different plants, notes are given on insect enemies. In conclusion, a summary is given of the more practical methods for combating these fungus and insect pests.

Disease resistance of potatoes, L. R. JONES (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 87, pp. 39*).—On account of the increased interest in the possibility of disease resistance on the part of varieties of potatoes, the author was commissioned to inquire into the subject both in this country and in Europe.

The bulletin aims to present in a concise form what is known about disease resistance of potatoes. For the most part plant breeding with potatoes has been for resistance to the late blight, and this will continue to be the principal problem for some time, but there is promise of success in securing new varieties resistant to scab, dry-rot, bacterial blight, and other diseases. The author states that apparently scab diseases of tubers in Europe differ from those in this country, and certain varieties are known to be more resistant than others.

A potato disease known as blackleg, of bacterial origin, is prevalent in Europe, but is not as yet known to occur in this country, and while varietal resistance to this disease is not fully established, it seems that certain thick-skinned varieties rich in starch are more resistant than the thin-skinned ones with a low starch content.

The late blight, or rot, due to *Phytophthora infestans* occurs more commonly in Europe than in America, and the principal investigations have been on the resistance to this disease. It seems from the information at hand that disease resistance is a relative characteristic, no variety being wholly proof against the blight or rot. It seems to be related to the general vegetative vigor of the plant, and in some instances resistance may be acquired by originating new varieties, but all seedlings will not show superior disease resistance.

It is believed that some of the wild species of tuber-bearing Solanums offer promise for hybridization, but as yet no practical results have been secured. The possibility of disease resistance being established by selection has not been proved, and it is said that early varieties may escape the disease by maturing before it becomes epidemic, but when similarly exposed they are as a class less resistant than late varieties. The source from which seed tubers is obtained is said to be a matter of importance, northern-grown seed giving plants of superior resistance in Europe, and possibly tubers are better for seed purposes if they are dug before they reach full maturity. High fertilization, especially with nitrogenous manures, lowers the power of the plant to resist blight and rot, and red varieties with thick, rough skin and relatively high starch content are usually more resistant than the thin-skinned white varieties, which are richer in protein.

So far as stem and foliage characters are concerned, the evidence favors varieties that have hard, rough, woody stems and small, rough, dark-colored leaves. In England the Evergood, Discovery, Royal Kidney, Northern Star, Sir John Llewelyn, King Edward VII, Eldorado, and Factor are rated high as to disease resistance, while in Germany and Holland the best types are Mohort, Irene, Geheimrat Thiel, Professor Wohltmann, Boneza, Eigenheimer, and Paul Krüger.

In this country trials as to disease resistance have been carried on at a number of the experiment stations, notably at the Vermont Station, where breeding and selection experiments for increased resistance are under way. In this country no variety seems especially preeminent in resistance, but Dakota Red, Rustproof, Irish Cobbler, Sir Walter Raleigh, Doe Pride, and White Beauty deserve mention as of the resistant class.

The evidence at hand seems to justify the hope that by the coordinated efforts of potato specialists it will be possible to develop varieties of potatoes combining general excellence with a high degree of resistance, and the author urges all interested to aid toward the accomplishment of this end.

Club root disease of swedes and turnips, D. A. GILCHRIST (*County Northumb., Ed. Com., Bul. 3, pp. 23-42, figs. 3*).—A description is given of club root of cruciferous plants and a record presented of experiments which have been carried on to test the effect of different dressings to check the disease. A short account of the fungus which causes the disease is also given.

In the experiments for the control of the disease varying amounts of lime were employed at different dates, and on the whole it was found that the application of lime to be most efficient should be made a considerable time in advance of the sowing of the crop. In some of the plats the best results were obtained where from 1½ to 2½ tons of lime were applied 2 years before seeding. In the most extended series of experiments, which covered several years' observations, the best results were obtained where 1½ tons of lime per acre were applied to all the plats 4 years before seeding. This treatment resulted in a considerably increased total yield and a greater freedom from disease.

A disease of artichokes, F. PARISOT (*Jour. Agr. Prat., n. ser., 10 (1905), No. 38, pp. 369–371*).—A disease of Jerusalem artichokes caused by the fungus *Sclerotinia libertiana* is described.

The disease is characterized by the appearance on the lower part of the stalks of brownish spots, which, as they become older, assume a tawny color. These spots frequently arise on the lower roots and also on the tubers, but are seldom observed more than 20 or 30 cm. above the soil. At the time of the development of these spots the plant becomes dried out, taking a brownish color, the leaves wilt, and falling from the plants become rapidly disintegrated on the ground, and the roots and tubers likewise rot rapidly.

For the prevention of this disease various methods have been suggested, but probably the most efficient is that of rotation so that artichokes will not occupy the same ground oftener than once in 3 or 4 years. The same fungus is known to attack potatoes, beans, corn, carrots, beets, ruta-bagas, sunflowers, and hemp, and these crops should not be used in any rotation where an attempt is made to get rid of the fungus.

Some diseases of cotton, G. VERT (*Bol. Agr. [São Paulo], 6. ser., 1905, No. 4, pp. 156–165, figs. 8*).—Notes are given on the fungus and insect enemies of cotton, principal attention being paid to the anthracnose caused by *Colletotrichum gossypii*. This disease is described at considerable length, the information being largely based on the publications of this Department.

Spraying for cucumber and melon diseases, W. A. ORTON (*U. S. Dept. Agr., Farmers' Bul. 231, pp. 24, figs. 8*).—The purpose of this bulletin is to describe briefly the common diseases of cucurbits and the practical requirements for their control. Among the diseases described are the downy mildew, leaf blight, anthracnose, a number of miscellaneous leaf diseases, bacterial wilt, and fusarium wilt.

The author briefly summarizes experiments carried on at a number of experiment stations on the control of cucurbit diseases, and gives the results of spraying experiments made under his direction at Charleston, S. C., in cooperation with the South Carolina Station. Directions for spraying are given in detail. The author's investigations showed that at a cost of $6.22 per acre 6 applications could be given cucumbers during a season. The experiments at Charleston resulted in the production of 150 baskets per acre, which were worth at market rates about $115. This was practically entire gain, as on account of the severity of the disease the plants would have been destroyed if they had not been sprayed.

Notes are given on the control of downy mildew, powdery mildew, and anthracnose, which sometimes attack cucumbers grown under glass.

Diseases of plants cultivated under glass, L. MANGIN (*Rev. Hort. [Paris], 77 (1905), No. 17, p. 414*).—In order to combat the principal diseases of plants grown under glass, the author recommends the sterilization of the soil by heat or steam and spraying the plants with copper fungicides or naphthol.

The copper has the disadvantage of staining the plants, and this may be avoided by the substitution of naphthol for the other fungicides. Naphthol in the proportion of 1 part to 10,000 is sufficient to prevent the germination of the spores of mildew and drop disease, the two principal diseases of plants grown under glass. The use of lysol in the proportion of 5 parts to 10,000 does not prevent the germination of the spores of these fungi.

Concerning the gummosis of oranges, A. L. HERRERA (*Com. Par. Agr. [Mexico], Circ. 19, pp. 4, fig. 1*).—A description is given of the foot rot or gummosis of oranges, which has become a serious disease in Michoacán.

The disease, according to the author, is probably due to the fungus *Fusisporium limonii*, and all species of citrus fruit seem to be subject to its attack. As a treatment the author recommends the removal of the soil for a distance of a meter about the trunk, exposing the upper roots. The roots may be treated with solutions of sulphurous

acid, carbolic acid, etc. Trees should not be planted in too heavy shade, and care should be exercised in the use of nitrogenous fertilizers. Attention should be paid that the roots should not be injured during the cultivation of the soil, and where trees are dead replanting should not be made in the same location.

Leaf curl and plum pockets, P. PASSY (*Rev. Hort.* [*Paris*], *77* (*1905*), *No. 14, pp. 340, 341, figs. 5*).—Illustrated descriptions are given of leaf curl, caused by *Exoascus deformans*, and plum pockets, due to *Exoascus* [*Taphrina*] *pruni*. For the prevention of these diseases it is recommended that the affected leaves and fruits be destroyed and the trees thoroughly sprayed late in winter with a rather strong solution of copper sulphate.

Notes for the recognition of the principal diseases of the grape, G. BERTONI (*Coltivatore, 51* (*1905*), *No. 29, pp. 73–76*).—Brief directions are given for the recognition of the principal diseases of the grape, the different diseases being grouped according to the part of the plant affected.

Grape anthracnose, E. ZACHAREWICZ (*Rev. Vit., 24* (*1905*), *No. 605, pp. 76, 77*).—For the prevention of anthracnose of the grape, the author recommends a winter treatment in which the vines should be thoroughly washed or sprayed with a solution of 10 kg. sulphuric acid in 100 liters of water. This should be applied during the dormant period of the vines, and should be followed during the growing season by 2 or 3 treatments of the foliage at 10-day intervals with powdered lime 50 kg., cement 25 kg., and mineral superphosphate 25 kg.

The treatment of Botrytis on grapes, P. DE LA BATHIE (*Rev. Vit., 24* (*1905*), *No. 604, pp. 37–39*).—A report is given of experiments in which a large number of fungicides, both in liquid and powdered form, were tested for the prevention of the gray rot of grapes, caused by *Botrytis cinerea*. In addition comparisons were made of the effect of removing the leaves and of reducing the amount of nitrogenous fertilizers in proportion to the phosphatic ones used in the vineyards.

In all, 6 forms of powder and about one dozen liquids were tested. The results of the treatments showed that in a season unfavorable to the development of this disease no treatment seemed to show any material reduction in the disease from that observed in the check plats. It is believed, however, that if the season had been a rainy one some of the fungicides would have shown a marked influence in the reduction of disease. Modifying the formulas of fertilizers in general use would probably have an effect on the reduction of the disease, and shallow cultivation is recommended to replace deep cultivation, which brings about too great nitrification in the soil.

Treatments for the prevention of powdery mildew, M. CERCELET (*Rev. Vit., 23* (*1905*), *No. 592. pp. 443–445*).—The author recommends washing grapevines with a mixture of water 100 liters, sulphuric acid 5 liters, and sodium hyposulphite 1 kg.

This should be applied to the vines between December 1 and February 1, or an application of a 10 per cent solution of sulphuric acid may be used. This should be followed during the season with other treatments, for the first of which is recommended a mixture of copper sulphate 1.5 kg., sublimed sulphur 2 kg., lime 0.75 kg., and water. For later treatments the quantity of copper and sublimed sulphur is increased about 50 per cent. These proportions will make about 1 hectoliter of fungicide.

Powdery mildew and Uncinula spiralis, P. PACOTTET (*Rev. Vit., 23* (*1905*), *No. 601, pp. 681–685, figs. 3*).—A description is given of the conidial form of the powdery mildew and its relation to the perfect form, *Uncinula spiralis*. The life history of the conidial form is described at length and notes given on its distribution in France, methods of control, etc.

The black rot, F. VASSILLIÈRE (*Rev. Vit., 24* (*1905*), *No. 605, pp. 65–70*).—An account is given of the appearance, distribution, and periodicity of attacks of black rot in France.

This disease was first observed at Ganges in 1885 and quickly spread throughout other portions of France. For combating the disease the thorough use of Bordeaux mixture is advised, the applications to be made with reference to the periods of fungus invasion.

Invasions of black rot in 1904, J. CAPUS (*Rev. Vit., 23 (1905), Nos. 594, pp. 485–489; 595, pp. 523–528; 596, pp. 549–552; 597, pp. 574–577, fig. 1*).—The results of the author's observations on the appearance and periodicity of black rot in 1904 are given. The relation between the appearance of the fungus and the atmospheric conditions are discussed at considerable length.

The treatment of black rot, A. PRUNET (*Rev. Vit., 23 (1905), No. 593, pp. 461–464*).—The author recognizes 2 forms of black rot invasion. The first is caused by the development of the fungus from the spores carried over during the winter, and the second, which appears later, develops from the spores produced during the primary invasion.

For the reduction of the first invasion, all fruits which remain on the vines should be destroyed, as well as the foliage on the ground, and for the later attacks the use of fungicides is recommended. The first application should be made when the plants have attained 2 or 3 small leaves, and this should be followed at intervals of from 8 to 10 days during the season. Fungicides containing 3, 4, and 5 per cent copper sulphate have been tested, and it was found that a 2 per cent solution is to be preferred in combating the black rot.

Combined treatment for the prevention of diseases of the grape, E. ZACHAREWICZ (*Rev. Vit., 23 (1905), No. 593, pp. 476–478*).—For the prevention of downy and powdery mildew and white rot the author recommends an early application of a fungicide composed of copper sulphate 1 kg., powdered soap 1 kg., and water 100 liters.

If the season is exceptionally rainy the addition of ½ kg. each of the copper sulphate and soap is recommended. For the later applications the author recommends powdering the vines with crude plaster 70 kg., powdered soap 5 kg., and sulphosteatite 25 kg. A second treatment with the liquid fungicide just before flowering is recommended, to be followed later by an application of triturated sulphur 80 kg. and sulphosteatite 20 kg.

A new rose disease in Austria, G. KÖCK (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 7, pp. 660–666, fig. 1*).—Notes are given on a newly recognized disease of roses. It is said to be caused by *Coniothyrium wernsdorffiæ*, a recently described fungus that attacks the rose canes, causing serious losses. An outline of experiments conducted for its repression is given, in which the canes were treated with a copper lysol mixture, Bordeaux mixture, and a trade solution known as Kerrow. No results are reported.

Sulphur fungicides, J. M. GUILLON (*Rev. Vit., 23 (1905), No. 590, pp. 378–383*).—The author describes the preparation of fungicides composed of Bordeaux mixture and different forms of sulphur.

He says that when freshly mixed these fungicides should have a greenish color, which as the mixture stands, becomes gray and later black. The advantage of the use of such a mixture is that it permits of the simultaneous treatment of grapevines for protection against both powdery and downy mildew. The principal disadvantage is due to the fact that the sulphur does not dissolve but is held in supension in the mixture, and this requires constant stirring.

The settling of the sulphur from the mixture may be retarded somewhat by the formation of a gelatinous oxid or carbonate of copper, but not wholly checked. When the freshly prepared combined Bordeaux mixture and sulphur is properly applied in good season, its action is said to be superior to that of the ordinary Bordeaux, supplemented by the use of dry sulphur.

The adherence of copper fungicides, J. M. GUILLON and G. GUIRAND (*Rev. Vit., 23 (1905), No. 599, pp. 628–631*).—In continuation of the authors' previous experi-

ments (E. S. R., 10, p. 651), the adherence to vegetation of different solutions of copper has been studied. When applied to field conditions, their earlier theoretical conclusions were confirmed to some extent.

The relative adherence of the different solutions when freshly prepared is given in the following order: Those fungicides containing soap, bicarbonate of soda, neutral carbonate of soda, lime, potassium carbonate, eau celeste, and verdigris; fungicides containing gelatin; those to which molasses is added; and finally, neutral verdigris solution. All the solutions were found to be more adherent if applied when very fresh. Bordeaux mixture preserves its adherence for an especially long time if the temperature is high, while the fungicides containing soda compounds, as well as Burgundy mixture, and those containing soap rapidly lose their adhesiveness when the temperature becomes very high.

The fungicides in most common use are grouped in the following order, based upon their adherence: Those containing carbonate of soda and Burgundy mixture, Bordeaux mixture, and neutral verdigris solution.

The adherence of copper fungicides, E. CHUARD and F. PORCHET (*Rev. Vit., 24 (1905), No. 604, pp. 33–37*).—Reviewing the work of Guillon and Gouirand (E. S. R., 10, p. 651) the authors claim that the conclusions given for adherence are based upon theoretical considerations and are not applicable to field practice.

To test the adherence of Bordeaux mixture, soda Bordeaux, and verdigris solutions experiments were carried on in 9 districts, the different solutions being sprayed upon the vines in 2 or 3 per cent solutions for the Bordeaux mixtures and 1 per cent solution for the verdigris, the quantity of liquid used varying from 890 liters per hectare for the first treatment to 1,330 liters for the fourth treatment.

Summarizing the authors' observations the solutions may be ranked in the following order, based upon the average of all their investigations: Neutral verdigris the most adherent, followed by what is called an adherent mixture of verdigris, Bordeaux mixture, and Masson's solution. Under the meteorological conditions in the vineyards of Vaud the neutral verdigris solution was by far the most adherent of any of the fungicides tested.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Winter manual of practice in economic zoology, H. A. GOSSARD (*Ohio Sta. Bul. 164, pp. 36, figs. 11*).—In order to outline correct practice in combating injurious insects during different seasons of the year, the author proposes to issue a manual on this subject for each of the 4 seasons. The present one is the first of the series.

Many of the insects mentioned in this bulletin may be more effectively controlled by insecticide work during other seasons than winter, but good work can be done in winter and the farmer usually has considerable spare time during this season. Attention is called to the importance of clean farming and fall plowing in the control of insect pests. These practices are important in general field work, and even more so in the vegetable garden.

Notes are given on the condition in which various insects hibernate, such as cutworms, grasshoppers, asparagus beetles, squash bug, squash borer, pea weevil, cucumber beetle, Harlequin cabbage bug, bean weevil, etc. The relation of birds to the farmer is also briefly discussed, with an account of the feeding habits of chickadee, white-breasted nuthatch, golden-crowned kinglet, blue birds, woodpeckers, hawks, owls, shrikes, etc.

In a discussion of orchard practice, attention is called to the winter state of certain orchard pests, including various plant lice, scale insects, tent caterpillars, fall webworm, codling moth, bud moth, apple-tree borers, fruit-tree bark-borer, pear psylla, plum curculio, peach-tree borer, and other pests affecting cherry, grape, and small fruits. These pests and others are presented in a table showing the crop affected,

the stage in which the insect passes the winter, the features by which it may be recognized, and the treatment to be applied.

The grouse and wild turkeys of the United States, and their economic value, S. D. JUDD (*U. S. Dept. Agr. Bur. Biol. Survey Bul. 24, pp. 55, pls. 2*).—An account is given of the feeding habits of prairie hen, heath hen, lesser prairie hen, sharp-tailed grouse, sage grouse, ruffed grouse, Franklin grouse, dusky grouse, willow ptarmigan, white-tailed ptarmigan, and wild turkey.

In connection with prairie hen and ruffed grouse an account is also presented of their preservation and propagation. The 12 species of grouse which occur within the limits of the United States including Alaska may be arranged in three groups according as they occupy the open plains, forested regions, or the mountain summits. Attention is called to the diminution in numbers in most of these important game birds, including wild turkey, and to the desirability of having experiments instituted to determine the feasibility of propagating them in a semidomesticated condition.

Detailed notes are given on the feeding habits of all species concerned, as based on the examination of stomach contents.

A new method of destroying field mice, E. SCHRIBAUX (*Jour. Agr. Prat., n. ser., 9 (1905), No. 22, pp. 708–710*).—A comparison was made to determine the effectiveness and relative cost of baryta bread and Loeffler's virus in destroying field mice.

As a result of these experiments it was found that baryta was not only very efficacious in destroying mice but was easy of application and comparatively inexpensive. The treatment of 1 hectare of infested ground with baryta cost about one-half as much as treatment with Loeffler's virus by the ordinary method and about the same as the modified method of applying the virus. The virus, however, in the author's opinion suffers from the disadvantage of being uncertain in its effects.

Injurious insects and other animals observed in Ireland during the year 1904, G. H. CARPENTER (*Econ. Proc. Roy. Dublin Soc., 1 (1905), No. 6, XIV, pp. 281–305, pls. 4*).—*Tipula oleracea* continues to cause damage to cereals by attacking the roots. In some localities whole fields of oats were destroyed by the larvæ of this pest.

In controlling the insect it is desirable that pastures be closely grazed before plowing, and that potatoes or a similar crop be grown on the soil before oats and other cereals. Biological and economic notes are also given on the frit fly, *Chlorops tæniopus* on barley, millipedes, *Tylenchus devastatrix* on oats, cabbage-root maggot, *Pegomyia betæ*, pea weevil, *Lipura ambulans* and *Lohmannia insignis* on kidney beans, *Acidia heraclei* on celery, pear midge, apple-plant louse, black-currant mite, *Rhabdophaga heterobia* on willows, etc.

The study of insects, M. T. COOK (*Estac. Cent. Agron. Cuba Circ. 14, pp. 7, pls. 3*).—A brief account is given of the structure and classification of insects for the use of farmers and fruit growers.

Insect notes (*Agr. News [Barbados], 4 (1905), Nos. 90, p. 298; 91, p. 314; 92, p. 330, figs. 4*).—Citrus plants are said to have been attacked by *Epicærus ravidus*. Brief notes are given on beneficial insects in cotton fields, cane fly in Barbados, hair-follicle mite of pigs, corn earworm, knapsack sprayer, and spraying cattle for ticks.

Entomological notes, J. KOTINSKY (*Hawaii. Forester and Agr., 2 (1905), No. 9, pp. 266–269*).—In this article the author discusses mango weevil, Asiatic ladybird, towoomba ladybird, and San José scale.

The Asiatic ladybird has been introduced into Hawaii, but the importance of this beetle in the destruction of scale insects in the Territory has not been determined. *Rhizobius towoomb* was observed feeding upon various scale insects. The present status of San José scale was also briefly outlined.

Report of the nursery inspector, A. E. STENE (*Ann. Rpt. Bd. Agr. R. I., 20 (1904), pp. 24–43, pls. 2*).—A copy is given of the nursery inspection law of Rhode Island with a commentary on the purpose and operation of the law. Brief notes are

also given on fumigation and inspection under the law and the construction of fumigation houses. Brief abstracts are also given of the inspection laws of other States.

Injurious insects, F. CORBOZ (*Chron. Agr. Vaud, 18 (1905), Nos. 11, pp. 265–269; 12, pp. 290–293*).—An account is presented of the habits, life history and means of combating cabbage maggot, *Ortalis cerasi*, onion maggot, larvæ of crane flies, plant lice on apple, pear, plum, peach, cherry, and gooseberry, *Lecanium persicæ*, and oyster-shell bark-louse.

Field experiments and observations on insects injurious to Indian corn, S. A. FORBES (*Illinois Sta. Bul. 104, pp. 95–152, fig. 1*).—Corn suffers considerable injury from year to year from the attacks of timothy billbugs, of which *Sphenophorus parvulus* was perhaps the most important species observed in the work reported in this bulletin.

In timothy fields near infested corn from 50 to 75 per cent of the timothy bulbs were infested. Adjacent corn fields were injured so that the yield was reduced from 50 to 20 bu. per acre. Careful observations in one field indicated that billbugs had affected about 29 per cent of the hills of corn, diminishing the number of stalks to the extent of 14 per cent and the number of ears 40 per cent. In this field the total loss was estimated at 18 per cent of the crop. A large proportion of this injury may be prevented according to the author's observations by early fall plowing of the timothy sod, and it is recommended that corn should not be planted on timothy sod recently plowed.

The corn-root aphis was carefully studied from the standpoint of its life history and also with regard to successful remedial measures against it. In this study observations were made on the agency of ants (*Lasius alienus*) in carrying the root lice from place to place. In work on insecticide remedies against this pest it was found that by means of disking the ground 3 or more times before the corn was planted the number of hills infested by ants was reduced by 64 per cent and those nfested by the root lice by 82 per cent.

In one instance a single treatment with the disk harrow, as soon as the ground was dry enough to be worked, reduced the number of insects in the field by 90 per cent. This remedy is, therefore, strongly recommended on account of the fact that the extra tillage is not only effective in destroying the corn-root aphis but is of advantage in putting the soil in better condition for the corn crop. Incidentally, it was observed that infested corn land planted once to oats becomes freed of the root aphis.

Elaborate experiments were carried out in determining suitable insecticide methods in controlling chinch bugs. In the use of barriers it was demonstrated that chinch bugs could be effectively kept in check for 4 weeks by means of a strip of coal tar which cost at the rate of $22.40 a mile. In dry years the barrier must be kept intact for 10 days and in wet years perhaps as long as 30 days. It was found necessary to pour fresh tar along the line about 3 times every 2 days. In case the barrier, for any reason, should prove ineffective the chinch bugs may be destroyed by the use of kerosene emulsion. For this purpose a 4 per cent emulsion was found highly effective and not injurious to the corn.

The emulsion was used at the rate of about 2 gal. per acre and was simply flirted upon the corn by the hand. A single treatment was, in some cases, sufficient to reduce the chinch bugs below the danger point. It required a man about 2 hours to treat an acre which would give an average of about 5 acres for a day's work. Whale-oil soap at the rate of ½ lb. to 1 gal. of water is also found to be a safe and successful insecticide for the destruction of chinch bugs, but its cost is about 3 times that of the kerosene emulsion.

The literature relating to the use of the gasoline blast lamp in the destruction of insects is reviewed in considerable detail. The author had already tested this device in the destruction of other insects and experiments are reported in the bulletin of its

effectiveness in the control of chinch bugs. It was found that by giving 2 or 3 treatments at intervals sufficient to allow the chinch bugs which fall off uninjured to crawl upon the corn again, badly infested corn could be almost completely freed from chinch bugs, but corn was almost sure to be somewhat injured unless care was exercised.

Insects and diseases of tobacco, M. T. COOK and W. T. HORNE (*Estac. Cent. Agron. Cuba Bul. 1, pp. 23, pls. 7*).—In this account the author devotes attention chiefly to the tobacco horn worm, cutworms, species of Prodenia, *Epitrix parvula*, cigarette beetle, and other less important tobacco insects.

A test was made of fumigating infested tobacco with bisulphid of carbon and hydrocyanic-acid gas. These materials were used at a greater strength than was required to destroy the cigarette beetles or other insect pests. Apparently the quality of the tobacco was not injured thereby. Notes are also given on other insecticide treatments for tobacco insects together with an account of mosaic disease, tobacco leaf spot, *Orobanche ramosa*, and other parasites.

Insect pests of the carrot, P. LESNE (*Jour. Agr. Prat., n. ser., 10 (1905), No. 27, pp. 16–19, pl. 1*).—The larvæ of the crane fly are reported as causing great damage to carrots. Notes are also given on *Psila rosæ*, *Depressaria nervosa*, etc.

The potato moth, C. FULLER (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 9, pp. 873–876, pl. 1*).—A serious outbreak of this insect is reported in which about 25 per cent of the potatoes on one estate were destroyed for several years in succession. The habits of this pest are briefly discussed.

In preventing serious injury from the potato moth it is desirable that infested seed should never be planted; the soil should be thoroughly cultivated and care be taken not to leave any tubers exposed since they may become affected in the field. The moths may be captured to some extent by the use of lantern traps. Potatoes should be stored in rooms, barrels, or other receptacles which the moths can not enter. Bags do not protect the tubers from infestation.

Caterpillars which may hatch upon the potatoes between the time of digging and storing may be destroyed by dipping the tubers in a solution of corrosive sublimate.

The social organization and breeding habits of the cotton-protecting kelep of Guatemala, O. F. COOK (*U. S. Dept. Agr., Bur. Ent. Bul. 10, tech. ser., pp. 55*).—The report presents evidence to show that the breeding habits of the Guatemalan kelep and its methods of founding new colonies are essentially different from those of true ants and quite strikingly resemble those of the honey bee.

In the author's opinion this type of organization will facilitate the establishment of the kelep in the cotton fields of the South, provided the insect is able to withstand the climatic conditions of that region. The author discusses in considerable detail the social organization of the kelep with comparative notes on the organization of other social insects, including the ants, termites, bees, bumblebees, etc.

As a result of a continued study of this insect it is believed that it furnishes considerable protection against the boll weevil, does not attack plants, is not a true ant, and may be established in colonies in the Texas cotton fields.

Spraying experiments for San José scale in 1905, T. B. SYMONS and A. B. GAHAN (*Maryland Sta. Bul. 107, pp. 57–62*).—Spraying is now recognized in Maryland as a part of the general routine of orchard work, and satisfactory results obtained from intelligent spraying indicate the profit from this operation.

During the year a number of insecticides were tested. Kerosene limoid in a 20 per cent solution interfered very little with the breeding of San José scale and the trees were nearly as badly infested in the fall as were untreated trees. In 25 per cent solution the insecticide was slightly more satisfactory, but in no case did the results compare with lime, sulphur, and salt.

Lime, sulphur, and caustic soda without cooking gave satisfactory results, but was not as effective as boiled lime and sulphur. Lime and sulphur (20–15) or lime, sulphur, and salt (20–15–12) boiled for 45 minutes gave very good results, and demonstrated anew the effectiveness of this wash. The results obtained from the use of Kill-O-Scale, Con-Sol, scalecide, and horicum were not promising. The author recommends lime and sulphur as the most satisfactory spray for San José scale. Wherever possible it is best to boil the mixture, otherwise a fairly satisfactory solution may be made by the use of caustic soda.

Formulas are given for the preparation of these insecticides. Where only one application is made it is recommended that treatment be postponed as late as possible in the spring.

The San José scale in Mississippi, and the lime-sulphur-salt wash, G. W. Herrick (*Mississippi Sta. Bul. 90, pp. 15, figs. 5*).—San José scale has been known to occur in Mississippi since 1897.

Lime-sulphur-salt wash is believed to be the best remedy for this pest. A formula, 20–15–10–45 is recommended, and the author boiled the mixture for 2¾ hours. When applied in February during a rain storm the results were not wholly satisfactory, but a second treatment in December destroyed about 90 per cent of the insects. The author states that the mixture can be made satisfactorily by boiling 1 hour. Brief directions are given regarding pumps, nozzles, pruning orchards, summer treatment, etc.

In one case an orchardist was able to hold the scale insect in check by severe pruning and painting the branches and trunks with a thick coat of lime-sulphur-salt wash. For summer treatment kerosene emulsion prepared according to the formula 2 lbs. soap, 4 gal. soft water, and 8 gal. kerosene is recommended.

Report on work done in 1901–2 in the control of San José scale and other dangerous insect and fungus pests, J. H. Stewart (*West Virginia Sta., 1903, pp. 64, pls. 5*).—In this report the author presents a financial statement of the disbursements and receipts in the work of exterminating nursery and orchard pests, and also an account of the experiments carried out along this line.

The purpose of the State law under which the work was carried on was to prevent the introduction of insect and fungus diseases or their further distribution after being introduced, the inspection of nursery stock and orchards, and the adoption of measures for eradicating pests. A list is given of the nurseries inspected with notes on the extent of work done. During the years under report 98 orchards, aggregating about 270,000 trees, were inspected. The distribution of San José scale was mapped out.

Experiments were carried out in controlling San José scale by natural enemies, fumigation, and spraying. In orchard work fumigation suffers from several disadvantages, including expensiveness, inefficiency, and danger. Notes are given on the application of crude oils, whale-oil soap, lime-sulphur wash, potash-sulphur spray, and other insecticides. A number of bulletins previously issued by the station and already noted are included in the report.

The San José scale, A. Maclellan (*Ann. Rpt. Bd. Agr. R. I., 20 (1904), pp. 114–116*).—The economic importance of this pest is briefly discussed. As remedies for the San José scale, the author recommends a lime-sulphur-salt mixture containing 40 lbs. lime, 20 lbs. sulphur, and 15 lbs. salt, as well as other similar formulas.

The San José scale and gypsy moth, E. H. Armstrong (*Ann. Rpt. Bd. Agr. R. I., 20 (1904), pp. 102–119, pl. 1*).—Particular attention is given in this article to a discussion of the appearance, life history, habits, and distribution of the gypsy moth with especial reference to suitable means for controlling the pest.

The black-currant gall-mite, P. M. Thomson (*Mem. Roy. Caledonian Hort. Soc., 1 (1905), pt. 1, pp. 63–75, figs. 3*).—This account of the habits, life history, and

means of combating *Eriophyes ribis* is largely quoted from the writings of C. Warburton. It is urged that in order to combat this pest successfully all the fruit growers of a given district must cooperate.

Diaspis pentagona on the mulberry and other insect pests (*Crón. Agr. [Argentina], 1 (1905), No. 7, pp. 91-99*).—*Diaspis pentagona* is said to be one of the most important pests of mulberries, and notes are given on its habits and life history and on artificial methods for controlling it. These methods include the use of mixtures containing heavy oil of tar and carbonate of soda or kerosene fish oil and carbonate of soda.

The mango weevil in Hawaii, D. L. VAN DINE (*Hawaii. Forester and Agr., 2 (1905), No. 8, pp. 231-233*).—*Cryptorhynchus mangiferæ* was found in July, 1905, in the seeds of mangoes.

It appears that this mango pest, while widely distributed throughout the Tropics, has been recently introduced into Hawaii. The life cycle of the insect is passed chiefly within the seed and the pest is therefore a difficult one to combat. In the first lot of mangoes examined about 60 per cent was found to be infested. A strict quarantine is recommended, together with the destruction of all infested fruits which fall to the ground. If the adult beetles feed upon the leaves of the mango they may be poisoned by arsenicals.

Two new shade tree pests, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 233, pp. 47-62, figs. 8*).—The author reports the occurrence of *Kaliosysphinga ulmi* on English and Scotch elms.

This insect probably occurs quite generally in New York State. Sometimes 20 or more larvæ were found mining in a single leaf. The larvæ produce blisters on the elm leaves, which show a dirty white color and shrivel up. On the European alder *K. dohrnii* was observed. This insect also produces brown mines or blisters on the leaves of the European alder. It is believed that it was introduced into America about 20 years ago. The pest has been noted in a number of localities in New York State. The life histories of both species are discussed.

In combating these pests it has been found sufficient to bury the cocoons from 2 to 4 in. under the soil. By removing 1 or 2 inches of the sod or soil from beneath infested trees about May 1 and burying it or otherwise treating it the pest can be controlled.

The fir Pissodes in the Vosges, M. HENRY (*Bul. Soc. Sci. Nancy, 3. ser., 6 (1905), No. 2, pp. 19-26, pl. 1*).—The author describes *Pissodes piceæ*, with notes on its habits, life history, and injurious effects upon the fir trees. In order to combat this pest it is desirable to mark all trees which show signs of infestation during the winter and to cut these trees before the insects emerge in the spring. After such trees are felled the bark should be removed in order to destroy the beetles underneath it.

The buffalo carpet beetle, J. FLETCHER (*Canad. Ent., 37 (1905), No. 9, pp. 333, 334, fig. 1*).—This pest appears to be increasing in importance in Canada. In some localities it has been found in considerable numbers on flowers out of doors.

Notes are given on the habits and life history of the pest. It is suggested that the beetle may be prevented from entering houses by the use of fine mosquito netting put on early in the season. Carpets should be regularly and thoroughly beaten out of doors, and all crevices should be treated with benzine, gasolene, or some similar insecticide.

Modern beekeeping; its helps and hindrances, J. W. BLAKE (*Mem. Roy. Caledonian Hort. Soc., 1 (1905), pt. 1, pp. 42-47*).—A brief discussion is presented of the comparative merits of different breeds of bees, the practical devices necessary for successful beekeeping, foul brood, and other hindrances which may be encountered in the business.

Sericulture in Italy, China, and Japan, H. P. SMITH ET AL. (*Mo. Consular Rpts. [U. S.], 1905, No. 296, pp. 337-388*).—The present reports are in response to a cir-

cular letter addressed to the consular officers in Italy, China, and Japan, requesting an investigation of sericulture as conducted in those countries.

The points covered by the reports include the raising of cocoons, silk reeling, number of workmen, status, training, and compensation of the workmen, mulberry culture, hatching of silkworm eggs, silk manufacture, storage of cocoons, diseases of silkworms, government aid of sericulture, etc.

Report on the condition of the Italian silk trade and on the yield of cocoons in Italy in 1904, P. CHAPMAN (*Diplo. and Cons. Rpts. [London], Misc. Ser., 1905, No. 632, pp. 9*).—The Italian silk market was in an unfavorable condition at the beginning of the breeding season for 1904. The price of raw silk rose considerably, so that certain manufacturers deserted the market, thus causing a fall in the value of raw silk. Notes are given on the results of breeding experiments during 1904. The cross white-yellow breeds are preferred in Italy, especially those of Chinese origin.

FOODS—HUMAN NUTRITION.

A digest of Japanese investigations on the nutrition of man, K. OSHIMA (*U. S. Dept. Agr., Office Expt. Stas. Bul. 159, pp. 224*).—The Japanese have for a number of years been actively engaged in experiments which have to do with the nutritive value of foods, food requirements under different conditions as regards occupation and environment, and similar topics, and have also studied many of the more technical questions connected with the general theories of nutrition.

In this digest the author has summarized dietary studies, digestion experiments, and experiments in which the income and outgo of nitrogen were determined, and has discussed the work at considerable length. Many of the investigations included have been published only in the Japanese language, and hence were not accessible to most investigators outside of Japan.

The digestibility and nutritive value of cottage cheese, rice, peas, and bacon, H. SNYDER (*Minnesota Sta. Bul. 92, pp. 259–275*).—Using healthy men as subjects, the digestibility of cottage cheese, rice, dried peas (soup or purée), and bacon was studied.

These foods were combined with one another and with other articles to constitute simple rations, but in such a way that the nutrients furnished by the foods specially studied constituted a large proportion of the total ration. Thus, in the experiment with cottage cheese 1.1 lbs. was consumed on an average per man per day, this amount supplying over 40 per cent of the total protein and 28 per cent of the total fat of the ration. In addition to the usual experimental data the nitrogen and specific gravity of the urine were recorded. The following table shows the average digestibility of the rations studied:

Coefficients of digestibility of rations containing cottage cheese, rice, peas, and bacon.

Kind of diet.	Protein.	Fat.	Carbohydrates.	Available energy.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Cottage cheese ration	95.30	95.44	97.54	90.36
Rice ration	91.46	96.10	97.77	89.81
Dried peas and rice ration	87.14	94.42	97.19	90.01
Bacon and peas ration	83.90	96.17	95.82	87.08
Bacon and cottage cheese ration	94.42	96.78	98.42	89.57

According to the author 95 per cent of the fat and the protein and 97 per cent of the carbohydrates of cottage cheese alone were digested, while 90 per cent of the energy was available to the body. In the case of rice the values are 83 per cent protein, 98 per cent carbohydrates, and 90 per cent available energy. The values calculated for

peas alone were 80.4 per cent digestible protein and 96.20 per cent digestible carbohydrates, and for bacon 92 per cent protein (when combined with cottage cheese and bread) and 96.17 per cent fat. When eaten with peas the author states that the coefficient of digestibility of protein was lower.

The principal conclusions drawn from the experiments were in effect as follows:

Cottage cheese prepared from skim milk and enriched with cream is a cheap, digestible, and nutritious food, and when the materials for its preparation are produced on the farm it is one of the most economical foods that can be used. At 2 cts. per quart for skim milk and 35 cts. per quart for cream cottage cheese compares favorably with meats at 11 cts. per pound. No digestion disorders were experienced by any of the subjects on account of consuming such a large amount of cottage cheese per day. The men were all employed at hard farm labor, and the ration of which cottage cheese formed an essential part gave entire satisfaction.

Rice is easily digested when well cooked, but is no more completely digested than other cereal foods. In these experiments the carbohydrates (starch) of rice were more completely digested than the proteids. The proteids of rice were not as completely digested as the proteids of wheat bread. Rice is a food which supplies a large amount of carbohydrates and can be used to best advantage when combined with such foods as peas, cottage cheese, and meats, which are rich in protein. The rice samples used in these digestion trials were selected types of American grown rice, and the analyses show that they contained a larger amount of nutritive than is present in average imported rice, being equal in food value to flours of low gluten content.

When peas are used in the ration they supply a large amount of protein, although the proteids of peas are not as completely digestible as the proteids of rice and other cereals. Peas supply the body with about the same amount of digestible nutrients as beans. When judiciously combined with other foods peas form one of the cheapest sources of proteids for making well-balanced rations.

Lean bacon in a ration supplies a large amount of digestible nutrients and available energy. Compared with other foods bacon fat has a high coefficient of digestibility. The proteids of bacon were also found to have a high digestion coefficient. Lean bacon contains as much protein and about twice as much digestible fat as other meats, making it at the same and even at a higher price per pound a cheaper food than many other meats.

Bacon fat is easily digested, and when combined with other foods it appears to exert a favorable mechanical action upon digestion.

In a number of the tests milk constituted a part of the diet. The actual digestibility of rations in which milk was used was higher than the calculated digestibility of the individual foods, showing that when combined with other foods milk exerts a favorable influence upon digestibility.

The specific qualities of some digestive ferments, K. KIESEL (*Arch. Physiol. [Pflüger], 108 (1905), No. 6–7, pp. 343–368*).—Experiments with the proteolytic and milk-coagulating ferments of dogs and cattle led to the conclusion that, with the exception of the trypsin and pancreas rennin of the dog, these ferments have a specific action upon the casein of the respective animals.

The importance of specific differences of ferments in infant feeding is spoken of. According to the author the casein of cows' milk and dogs' milk possesses different properties. When the former is heated to a temperature of 90° C. or above it becomes in part insoluble in alkali, which is not the case with dogs' milk casein. On the other hand, when dogs' milk casein is heated to 90° C. or above it unites with more alkali than the unheated casein. In other words, it has become acid by heating.

Chinese bean oil, W. KORONTSCHEWSKY and A. ZIMMERMANN (*Vyestnik Obshch. Hig., Sudeb. i Prakt. Med., 1905, May; abs. in Biochem. Centbl., 4 (1905), No. 8–9, p. 292*).—Tests with soldiers showed that 95 to 100 per cent of bean oil, such as is used

in China as a culinary fat, is digested. When fresh this material is conceded to be a valuable nutrient. The oil (which was presumably made from soy beans) is rich in olein.

The fat-cleaving ferment of the mucous membrane of the stomach, A. FROMME (*Beitr. Chem. Physiol. u. Path.*, *7* (*1905*), *No. 1-3*, *pp. 51-76*).—The experiments reported furnished an additional demonstration of the presence of a fat-cleaving ferment in the mucous membrane of the stomach. One of the questions considered has to do with differences in the fat-cleaving ferment obtained from different animals.

The extent of fat digestion in the stomach, A. ZINSSER (*Beitr. Chem. Physiol. u. Path.*, *7* (*1905*), *No. 1-3*, *pp. 31-50*).—Experiments with normal and diseased subjects are reported. According to the author's results 25 per cent of the fat emulsion taken by the normal subjects had undergone cleavage after an hour's stomach digestion. This value is regarded as very probably an underestimate.

On the influence of copious water drinking, P. B. HAWK (*Reprinted from Univ. Penn. Med. Bul.*, *18* (*1905*), *No. 1*, *pp. 53*).—Three experiments are reported with healthy men in which comparatively large amounts of water (3,100 to 4,500 cc. daily) were added to a uniform basal ration which contained in the fore and after periods 500 cc. of water per day. Some of the principal conclusions which were drawn follow:

"Copious water drinking causes an increased excretion of nitrogen and phosphorus by the urine. The increase in the amount of nitrogen eliminated is due, primarily, to the washing out of the tissues of the urea previously formed, but which has not been removed in the normal processes, and secondarily, to a stimulation of proteid catabolism. The increase in the excretion of phosphorus is due to increased cellular activity, and the accompanying catabolism on nucleins, lecithins, and other phosphorus-containing bodies."

In one instance the increase in the nitrogen excreted in the urine after the ingestion of 9,000 cc. of water in 48 hours was 1.085 gm., or 9.8 per cent above the normal output.

The course of the sulphur excretion, the author states, showed a general tendency to run parallel with that of nitrogen, although it was somewhat irregular.

The influence upon the phosphorus excretion was distinctly different from that of nitrogen or sulphur. "In every instance the excretion of phosphorus was increased above the normal on each day of the water period, the maximum excretion occurring, with absolute regularity, on the second day of the increased water ingestion. There was a constant tendency for the largest percentage of the ingested fluid to be excreted by the urine on the days of copious water drinking. This was indicated by an elimination of 28.5 per cent on an ingestion of 2,300 cc. of fluid, as compared with an elimination of 90.6 per cent on an ingestion of 6,400 cc. of fluid."

Concerning the extractive material of muscular tissue. II, Carnitin, W. GULEWITSCH and R. KRIMBERG (*Ztschr. Physiol. Chem.*, *45* (*1905*), *No. 3-4*, *pp. 326-330*).—From meat extract the authors claim that a new substance was isolated for which the name "carnitin" is proposed. (For earlier work see E. S. R., 12, p. 1076.)

The hydrolysis of proteids. II, Gelatin, Z. H. SKRAUP (*Monatsh. Chem.*, *26* (*1905*), *pp. 243-264; abs. in Biochem. Centbl.*, *4* (*1905*), *No. 5*, *p. 137*).—The cleavage products of gelatin obtained by hydrolysis were studied and compared with bodies obtained in a similar way from casein. A new acid, for which the name "Leimsäure" was proposed, was identified.

The hydrolysis of meat extracts, K. MICKO (*Ztschr. Untersuch. Nahr. u. Genussmtl.*, *10* (*1905*), *No. 7*, *pp. 393-415*).—The hydrolysis of meat extract yielded considerable alanin and in addition glycocol and leucin.

The protective power of asparagin, M. MÜLLER (*Fühling's Landw. Ztg., 54 (1905), No. 13, pp. 437-441*).—Investigations showed that intestinal bacteria used asparagin as a nitrogenous nutrient in preference to proteid bodies which are soluble with difficulty. The nutritive value of the more complex bodies formed from asparagin by the micro-organisms and the bearing of this synthesis upon the nutrition of herbivora are spoken of.

The value of inorganic salts in metabolism, A. HIRSCHLER and P. VON TERRAY (*Ztschr. Klin. Med., 57 (1905), No. 1-2; abs. in Biochem. Centbl., 4 (1905), No. 8-9, p. 258*).—Experiments with young dogs showed that an egg diet with a high content of phosphorus in the form of lecithin was more favorable to gains in nitrogen and body growth than a milk and dried meat diet. Clinical experiments are also reported.

Measuring the body temperature through long periods, E. OERTMANN (*Arch. Physiol. [Pflüger], 108 (1905), No. 6-7, pp. 300-322, figs. 5*).—The author describes several forms of thermometers which he has devised for recording body temperature, and discusses his methods and those of other investigators. (See also E. S. R., 16, p. 999).

Principles of cookery, ANNA BARROWS (*Chicago: American School of Household Economics, 1904, pts. 1, pp. 1-54, figs. 18; 2, pp. 55-97, figs. 18; 3, pp. 99-139, figs. 13*).—In a series of lessons designed for instruction by correspondence different sources of heat, methods of cooking in water with dry heat, canning and preserving foods, principles of cookery, cooking of meats, vegetables, bread, and related questions are taken up.

Notes on food and diet in Cuba, C. F. LANGWORTHY (*Boston Cooking-School Mag., 10 (1905), Nos. 1, pp. 1-8, figs. 10; 2, pp. 77-79*).—A number of Cuban foods are described and food habits and dietetics briefly discussed.

Studies on an ash-free diet, A. E. TAYLOR (*Univ. Cal. Pubs. Path., 1 (1905), No. 7, p. 71; abs. in Biochem. Centbl., 4 (1905), No. 8-9, p. 258*).—The diet selected furnished 70 to 75 gm. protein, 120 gm. fat, 200 gm. sugar, and less than 0.1 gm. mineral salts per day.

After some days loss of appetite, muscular pains, and other unpleasant symptoms were noted. The metabolism of nitrogen and the assimilation of protein, however, were little affected. The conclusion was reached that the disturbances noted were due to the withdrawal of cations. The results are discussed from the standpoint of physical chemistry.

Meals served for twenty cents at dairies, J. TRIBOT (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 2, pp. 168, 169*).—Data regarding the food value of meals served at Paris dairies are reported with a view to determining the amount of nutrients supplied. This and the 2 following articles are a contribution to the study of French dietaries.

Meals served at restaurants for twenty-three cents and twenty-five cents, J. TRIBOT (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 2, pp. 169-176*).—On the basis of data gathered in 5 Paris restaurants, the character and nutritive value of meals served for a low price are discussed.

The physiological value of foods served at cheap restaurants in Paris, J. TRIBOT (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 2, pp. 176, 177*).—On the basis of data collected from cheap restaurants (soup kitchens) in Paris, frequented by workingmen, the character and nutritive value of the meals served are discussed.

Retail prices of food, 1890 to 1904 (*Bur. of Labor [U. S.] Bul. 59, pp. 148-301, dgm. 1*).—Continuing earlier work (E. S. R., 16, p. 688), statistics have been compiled showing the retail prices of food in a large number of American cities and towns.

Means adopted for the preservation of foods, HALPHEN (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 1, pp. 81-90*).—In a report presented to a committee of

the Society of Hygiene regarding the use of antiseptics, recommendation is made that the use of chemical preservatives be forbidden with the exception of such well-known preservatives as salt, smoke, sugar, spices, etc.

Food inspection, C. D. WOODS (*Maine Sta. Bul. 119, pp. 137–152*).—Data are given regarding the examination under the State pure-food law of a number of samples of baking powders and vinegars.

"While there were low-grade imitation vinegars on the market, no harmful ingredients were found. The fraud in every case was upon the pocketbook rather than upon the health of the consumer. . . . The makers and handlers of vinegar in the State are in apparent sympathy with the purpose of the law and desire to meet its requirements."

Report of food inspection, C. D. HOWARD (*N. H. Sanit. Bul., 2 (1905), No. 9, pp. 133–145*).—Data are given regarding the samples of honey, canned fruit and vegetables, jellies, extracts, etc., analyzed under the State pure-food law.

Report of work in food laboratory, H. E. BARNARD (*N. H. Sanit. Bul., 2 (1905), No. 8, pp. 118–125*).—Of the 426 samples of food products analyzed in 3 months, 55.4 per cent were found to be adulterated or to vary from the legal standard. The remainder were pure or of standard quality.

Data are given regarding the examination of the adulterated or sophisticated goods, which includes principally canned fruits, jellies and jams, honey, extracts, vinegar, molasses, maple sugar and sirup, meat products, and catsups.

The report regarding the law against adulteration, made to the Chamber of Deputies, FAYOLLE (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 1, pp. 1–80*).—A summary, discussion, and exposition of the French laws regarding fraud and adulteration.

Special report of analyses of condensed milks and infants' and invalids' foods, C. B. COCHRAN (*Penn. Dept. Agr., Mo. Bul. Dairy and Food Div., 3 (1905), No. 5, pp. 20–27*).—Analyses of condensed milks, malted milks, and similar goods are reported. The conclusion is reached that, as a rule, "the condensed milks put upon our markets are made from milk of fairly good quality."

Corn beef containing flour, H. MATTHES (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 12, p. 732*).—Flour was identified as an adulterant of canned corn beef.

[Sweet potato flour], T. M. WHELAN (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 8, pp. 834, 835*).—Experiments with sweet potatoes at the Winkle Spruit Experiment Farm are briefly spoken of, maturity of tubers and other topics are discussed, and an analysis of sweet potato flour reported.

Rotten eggs for food (*N. H. Sanit. Bul., 2 (1905), No. 9, pp. 149, 150*).—According to data summarized stale or rotten eggs when treated with formaldehyde become odorless and are sold to bakers and others for use in the preparation of foods. Prosecutions for the sale of such goods have been made in Massachusetts by the State board of health.

Judging egg noodles and similar goods, H. LÜHRIG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 3, pp. 153–159*).—The analytical data reported show, in the author's opinion, that egg noodles change somewhat in composition on storing, but that, whatever the age, it is possible, on the basis of analysis, to judge of the amount of eggs used in their manufacture.

The rancidity of fat, J. KLIMONT (*Österr. Chem. Ztg., 8 (1905), No. 11, pp. 249–253*).—A summary and discussion of investigations on the cause of rancidity of fat.

Concerning damaged tea, P. BUTTENBERG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1–2, pp. 110–117, fig. 1*).—Different methods of packing tea are discussed, with special reference to the possibilities of contamination with lead used for lining tea chests or other packages.

According to the author, there is little danger except in the case of tea which has become moist in some way. If the tea chests become wet in transport, considerable lead may be present in the tea and should be determined in judging of the possible use of such damaged goods.

Pure food division, H. D. GIBBS (*Health Dept. San Francisco, Bul., 1905, July, pp. 17-22; Aug., pp. 10, 11*).—The data reported cover the results of an examination of 215 samples of dry red California wines collected in the city and county of San Francisco. D. F. Ragan contributes some information regarding the amount of adulterated wine.

Judging the quality of wine vinegar, W. FRESENIUS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1-2, pp. 121-129*).—A paper with a discussion presented before the meeting of German Food Chemists in Dresden, 1905. In the author's opinion special attention should be paid to the amount of glycerin present in wine vinegar, as this offers a means of judging of the quality of the product.

ANIMAL PRODUCTION.

Alfalfa for the growing and fattening of animals in the Great Plains region, I. D. GRAHAM (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 242-267, pls. 5*).—In a discussion of alfalfa, a crop which, in the author's opinion, has revolutionized animal husbandry of the Great Plains region, data based largely on the work of the experiment stations and the experience of feeders and breeders are summarized.

Some of the questions considered are the composition and digestibility of alfalfa, the calculated cost of nutrients supplied by alfalfa and other feeding stuffs, the value of alfalfa hay cut at different periods of growth, alfalfa as a pasturage, soiling, and hay crop, alfalfa meal, and the value of alfalfa, fresh and cured, for different kinds of farm animals and for poultry. The importance of this crop as a honey-producing plant is also spoken of.

Finely ground, kiln-dried alfalfa hay is called alfalfa meal, and the author states has given satisfactory results as a feeding stuff. "The commercial article is made from selected alfalfa and mixed with sugar-beet molasses in the proportion of 75 per cent alfalfa and 25 per cent molasses."

The high feeding value of alfalfa for all classes of farm animals is pointed out. Some of the author's deductions follow:

Horses and mules, the author states, "thrive on alfalfa pasture. . . . While . . . alfalfa is too rich a food for mature horses unless used in combination with some other roughness, it is an excellent feed for young horses, as it seems to contain just the elements necessary to develop bone, muscle, and consequent size. Caution should be used, however, in feeding alfalfa to horses, particularly if they have not been accustomed to it. Like other concentrated feeds, it seems to stimulate all the physical processes to such an extent that various disorders of the digestive system may appear. This is particularly noticeable in the urinary and perspiratory glands. . . .

"When alfalfa is fed to horses in considerable quantity the grain ration must be proportionately reduced and an abundance of other roughness furnished. When horses have attained a mature age and it is desirable to change from other hay to alfalfa, this change must be very gradual, and the alfalfa selected for this purpose should be more advanced in growth at the time of cutting than that which is to be fed to cattle or sheep. As a general statement, very ripe alfalfa hay is the best to use for work horses and driving horses, while that prepared in the usual way—that is, cut when the field is about one-tenth in bloom—is better for the colts. In any event, horses that are fed alfalfa hay must be given abundant exercise."

For dairy and beef cattle and for sheep alfalfa has given very good results. As regards the use of alfalfa hay for pigs, the author states that "it is better to cut it

early so that a larger proportion of leaves may be saved and consequently a larger proportion of protein conserved. . . . A late cutting, after the leaves have fallen somewhat and the stem hardened, is better for horses, but for pigs, especially growing pigs, the crop should be so harvested as to save the largest number of leaves. Experience teaches also that the third or fourth crop is better for pigs because it is softer and more palatable. It is always wise to provide some sort of a trough or rack with a floor in it for feeding alfalfa to hogs. . . .

"Alfalfa in its green state, or when used as hay or ensilage, is a first-class poultry food. Poultry will pasture on it during the summer and thrive. . . . It is best for poultry to use the last cutting of alfalfa, as it is softer in texture, has a larger proportion of leaves, less woody matter, and is more succulent than any other cutting. While poultry of all classes will eat alfalfa hay, or at least the leaves from it, and thrive, it is undoubtedly a better practice to chop it or grind it and mix it with a grain ration. A good practice is to steep the alfalfa hay in hot water and let it stand for several hours before feeding."

The report reproduces photographs of a number of high-grade animals fattened or fed on alfalfa.

Cocoanut meal as a food stuff (*Agr. News [Barbados], 4 (1905), No. 87, p. 254*).—An analysis, by J. P. d'Albuquerque, of Trinidad cocoanut meal is reported, and the feeding value of this meal briefly spoken of.

Molasses as a food for work animals, W. H. DALRYMPLE (*Breeder's Gaz., 48 (1905), Nos. 6, p. 231; 7, pp. 276, 277; 8, pp. 325, 326; 15, p. 697*).—The importance of molasses as a feeding stuff for horses and mules is discussed, and data collected from 42 Louisiana plantations are summarized.

It is stated that the average amount fed to large mules is 8 to 12 lbs. per head per day, a gallon of blackstrap cane molasses weighing on an average 12 lbs. Chopped hay, peavine, or alfalfa, and some concentrated feed are commonly mixed with this amount of molasses and the whole fed in 3 portions. It is desirable to begin with smaller amounts of molasses when this material is first introduced into the ration.

The utilization of brewers' yeast (*Pure Products, 1 (1905), No. 5, pp. 268, 269*).—Data are summarized regarding the manufacture of feeding stuffs and other products from refuse brewers' yeast.

The destruction of foods and feeding stuffs by micro-organisms. V, The composition of slime due to bacteria, J. KÖNIG, A. SPIECKERMANN, and F. SEILER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 9, pp. 513–528*).—The principal conclusions drawn from the investigations reported follow: Slimes are formed by many bacteria growing not alone on sugar but also on some nitrogenous materials, such as peptone, asparagin, and glycocol. The slime obtained from liquid and solid nutrient media consists largely or entirely of dehydrated carbohydrates, in part fructose and glucose groups and in part galactose groups. Dextrin was not identified. A list is given of the slime-producing bacteria.

Cattle, sheep, and hog feeding in Europe, W. J. KENNEDY (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 77, pp. 98*).—On the basis of personal experience the author summarizes data regarding the cattle, sheep, and hog industry in Great Britain and on the continent of Europe.

"A very wide range of feeding stuffs is used, and diversity of methods prevails both as regards the compounding of rations and the preparation of feed. However, satisfactory results are usually obtained, and the methods employed exemplify in no unmistakable manner that no one combination of feeding stuffs is superior to all others to produce work, meat, milk, or uniform growth and development. For reasons of economy the feeders of each country must use, as far as possible, the feeds whose production is best adapted to the soil and climatic conditions of that country, and which can be grown at home.

"To an American the striking features of European methods are the large use made of roots, linseed and cotton cake, the large proportion of roughage to concentrates fed, the dependence placed on pasture and other green feed, the attention paid to the preparation of the feed, and the effort to use everything grown on the farm. Furthermore, although the most intensive methods are used to fatten cattle for market, the general tendency among breeders is to maintain breeding stock in good condition, but to avoid the extremely fleshy condition which often leads to barrenness and impotency.

"Roots are most extensively used in cattle production in England and Scotland, and these crops are very highly valued. They are fed to dairy cattle as well as to beef animals, but when feeding them to milch cows the best dairymen take pains to avoid tainting the milk by their use. Mangel-wurzels (commonly called mangels or mangolds), turnips, and ruta-bagas (commonly called swedes) are usually grown in Great Britain. In the continental countries, especially in France and Germany, the sugar beet and sugar-beet pulp are used. In some cases carrots are fed, especially to calves, and in the island of Guernsey parsnips are used."

As was the case with cattle, considerable diversity was noted in the methods of feeding sheep and pigs. The rations fed to these animals and to cattle are in many cases described in detail, the amounts of the different feeding stuffs used being recorded. It is the author's belief that European methods can not be adopted by American farmers without change, but that probably many features may be applicable to our conditions.

Special interest attaches to the section devoted to bacon production on account of the acknowledged excellence of the English, Irish, and Danish bacon.

The sheep industry of England, Scotland, Ireland, and France, W. J. Kennedy (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 81, pt. 2, pp. 71-87*).—A reprint from the publication noted above.

The score card in stock breeding, G. M. Rommel (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 76, pp. 54, figs. 7*).—This bulletin is made up of a compilation of the score cards used by breeders' associations in the United States certified by the Secretary of Agriculture and is intended as a supplement to Bulletin 61 of the Bureau (E. S. R., 16, p. 587). The material comprises standards for horses, beef cattle, hogs, and sheep, but does not include those for dairy cattle.

Cattle feeding experiment, H. R. Smith (*Nebraska Sta. Bul. 90, pp. 24, figs. 7*).—Using 5 lots of 10 2-year-old steers, the relative merits of different sorts of coarse fodder as a supplement to corn were studied.

The experimental rations were made up of shelled corn with prairie grass hay, alfalfa hay, and alfalfa hay and corn stover; and of corn and oil meal 9:1 with prairie grass hay and with sorghum hay. In the 24 weeks covered by the test the average daily gain per head ranged from 1.9 lbs. on corn and prairie hay to 2.4 lbs. on corn, alfalfa hay, and corn stover. The greatest range in cost of feed per pound of gain was from 6.49 cts. on the last mentioned ration to 8.27 cts. on the ration consisting of corn, oil meal, and prairie hay.

The coarse fodder required per pound of gain ranged from 3.82 lbs. with the lot fed sorghum hay to 5.19 lbs. with the lot fed corn and prairie hay, and the grain eaten per pound of gain from 7.89 lbs. on the ration containing corn stover to 9.52 lbs. on the corn and prairie hay ration. The greatest profit, $3.32 per steer, was obtained with the alfalfa and corn stover ration, and the smallest, $1.09 per steer, with the corn, oil meal, and prairie hay ration. Some of the author's conclusions follow:

"When the ration consisted of corn and prairie hay, the amount of grain required for each pound of gain was lessened 5 per cent by adding oil meal to the grain ration.

"The cost of producing a pound of gain was not lessened by the addition of oil

meal, but a better finish was secured, which caused the cattle to sell for 15 cents more per hundred. . . .

"Alfalfa is much superior to prairie hay when the grain consists of corn alone. It also proved to be a cheaper source of protein than oil meal. . . .

"Bright, well-cured corn stover fed with an equal weight of alfalfa, the grain consisting of corn alone, gave slightly larger gains than corn and alfalfa, and proved the most economical ration in the experiment. The addition of corn stover may have improved to some extent the corn and alfalfa ration by furnishing greater variety and by its tendency to check scours sometimes caused by alfalfa.

"Sorghum hay returned a value of $4.63 per ton in comparison with prairie hay at $6, each being fed with corn 90 per cent and oil meal 10 per cent. . . .

"While the profit was small, the steers returned a good price for the rough feeds at the market values quoted—high enough to make them profitable crops to grow on the farm. Had the feeds been sold, these values for roughage would not have been secured on the average Nebraska farm, nor would the manure have been left to make the next crop larger."

From this and similar work with yearling steers previously reported (E. S. R., 16 p. 586) the following general deductions are drawn:

"Alfalfa hay is pronouncedly superior to prairie hay for beef production, and the more rapid the extension of the area of land devoted to the production of alfalfa, supplanting the less valuable and lower yielding native hay, the more rapid will be the production of wealth from our soil.

"Native prairie hay, if for any reason it is most available for feeding purposes, should not be fed with corn alone, but rather with corn supplemented with a small quantity of some protein food, such as oil meal, to give more nearly a balance of nutrients in keeping with animal requirements.

"Cornstalks cut and put in the shock immediately after the ears ripen possess a food value which can not consistently be ignored by the farmer, and existing land values warrant the larger utilization of this roughness by the adoption of methods of harvesting that will make such material more valuable for feeding purposes."

Cattle and cattle raising in Brazil, H. von Ihering (*Separate from Jahrb. Deutschsprech. Kolon. São Paulo, 1 (1904), pp. 97–113, figs. 6, map 1*).—In a discussion of the problems of cattle raising in Brazil, Cuyabana, Caracú, Franqueiro, Torino, Zebú, and China cattle are described, as the author considers these breeds of especial importance for the local cattle industry.

Highland cattle, J. Roberts (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 227–241, pls. 4*).—The origin and history of highland cattle, characteristics and various points of the breed, feeding and management, and related questions are discussed. The author calls attention to the fact that there are not many representatives of this breed in the United States and gives some information regarding the whereabouts of the few American herds.

Ration experiments with lambs, 1904–5, G. E. Morton (*Wyoming Sta. Bul. 68, pp. 23, pls. 8*).—The comparative value of alfalfa and native hay, of barley and corn, and of flaxseed (ground without expressing the oil) was studied with 3 lots of 20 lambs and 2 lots of 3 lambs each. In addition to grain and hay all the lots were fed turnips.

At first the flaxseed used was mixed with the turnips, as otherwise the lambs would not eat it owing to its strong taste. After a time, however, it was eaten more readily. With all the rations containing alfalfa hay the nutritive ratio was about 1:5; with the native hay ration it was 1:10.5.

In the 16 weeks of the test the gains made on corn and alfalfa hay and barley and alfalfa hay were 31.2 and 33.1 lbs. per head; on corn and native hay, 20.7 lbs.; on flaxseed, corn, and alfalfa hay, 31.8 lbs.; and on flaxseed and alfalfa hay, 25.7 lbs. Rating turnips at $2 per ton the cost of a pound of gain ranged from 4.68 cts. on corn and alfalfa hay to 6.08 cts. on corn and native hay.

At the close of the feeding test a lamb from each of the lots, except that fed corn and flaxseed was slaughtered. The lamb fed barley gave the largest percentage of dressed weight (68 lbs.) and meat of the best quality. The lamb fed flaxseed and alfalfa hay was rated next as regards weight of dressed carcass, "but the meat was very dark colored and on that account not satisfactory, although it had a very fine flavor." The weight of the caul fat of this lamb was very high owing to the heavy flaxseed feeding. No urinary troubles were noted as a result of feeding flaxseed from which the oil had not been expressed.

According to the author, the investigation shows that "alfalfa and corn and alfalfa and barley are very nearly equal in feeding value, if they can be obtained at the same price. In fact, judging from the general condition of the lambs during the experiment, as well as from the gains made, barley is preferable to corn for feeding in conjunction with alfalfa.

"The ration composed of alfalfa, corn, turnips, and flaxseed evidently closely approaches in value the two just named. The alfalfa and flaxseed ration . . . is of doubtful value where corn or barley can be obtained cheaply and without long hauls. But feeders at points over 10 miles from a railroad who can combine farming with feeding might find it profitable to use flaxseed instead of grain. Flax is a native of the State, growing wild in places, and cultivated varieties yield well.

"Alfalfa, flaxseed, and turnips would make a good ration for a farmer feeder who could not obtain corn or barley cheaply."

The tests with flaxseed and barley have been noted from another publication (E. S. R., 17, p. 585).

Lamb feeding in the San Luis Valley (*Breeder's Gaz., 48 (1905), No. 8, pp. 310, 311, fig. 1*).—The successful use of pea-vine hay for fattening lambs is spoken of.

Notes on the Angora goat industry, G. F. THOMPSON (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 394–399, pl. 1*).—The author's official report as juror for Angora goats for the Louisiana Purchase Exposition is given, as well as information regarding the importation of mohair and Angora goat skins, Angora goats in Porto Rico and Cuba, and other current topics relating to the Angora goat industry. The export duty of £100, which is levied on Angora goats in South Africa, the author notes, practically prohibits their exportation from that country.

A consideration of mohair and mohair growing, with notes on observations in South Africa, G. A. HOERLE (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 400–405, pls. 2*).—Factors which constitute quality in South African mohair, the characteristics of the fleece of South African Angora goats, and other related topics are discussed on the basis of personal experience and observation.

Practical Angora goat raising, C. P. BAILEY (*San José, Cal.: C. P. Bailey & Sons Co., 1905, pp. 97, pl. 1, figs. 21*).—The feeding, breeding, care, and management of Angora goats, the quality of goat mutton, and related topics are taken up.

Proceedings of the horse industry congress, J. M. DE LAGORSSE (*Compt. Rend. Cong. Hippique, 1905, pp. 163*).—This volume contains a report of the proceedings of the congress held in Paris, June 23 and 24, 1905, for the purpose of considering horses and the horse industry, the papers presented at the meetings, with discussions, and related matters.

Fattening draft horses, J. W. COVERDALE (*Breeders' Gaz., 48 (1905), No. 25, pp. 1310, 1311*).—The essential points to be considered in feeding draft horses for the market, according to the author, are the selection of animals of good type and constitutional vigor, starting the grain ration carefully, the selection of a suitable ration when on full feed, toning up the system by giving a little saltpeter and glauber salts, abundance of clean bedding and quarters, and careful grooming and sufficient exercise before selling.

"The amount of each feed should be according to the appetite of the horse. . . . A heavy horse on full feed will eat about 18 ears of corn twice a day, 15 qts. of oats and bran mixed, and about 10 lbs. of hay."

Hunter-horse production in Ireland, W. J. KENNEDY (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 187-226, pls. 8*).—The breeding, feeding, care, and management of Irish hunter horses is discussed on the basis of information gathered by the author on a trip undertaken to study this industry.

It is pointed out that there is much lack of uniformity in Irish hunters, but that nevertheless there has been a ready market for Irish horses of all sorts, those of the highest type being purchased for hunting, while those bred along the same line but deficient in size and quality are sold for other uses and for smaller prices. The various classes for which there is a foreign demand at very good prices are weight-carrying hunters (heavy, medium, and light), mares and fillies for breeding purposes, saddle horses, officers' remounts, troopers' remounts, harness horses, and hack or cab horses.

The points to be observed in judging first-class heavy-weight hunters are given in detail, and the different crosses with hunters which are commonly met with are described. The influence of district and county shows, the work of the department of agriculture of Ireland, and other factors which aid in the development and improvement of the Irish hunter industry are spoken of.

Mount Serle government camel depot, J. DESMOND (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 1, pp. 7-12, figs. 4*).—Information is given regarding the care and management of the government camel herd of 30 males, 45 females, and a number of calves, and also regarding the successful castration of a number of males, an operation commonly supposed to be followed by a high death rate.

The causes of daily variation in body weight, J. LATSCHENBERGER and S. POLANSKY (*Arch. Physiol. [Pflüger], 108 (1905), No. 8-9, pp. 457-472, pls. 2*).—From experiments with 2 horses extending over 186 days the conclusion was reached that the gaseous excretory products are the chief factors which influence daily changes in body weight. Periodicity in the variations was noted.

An investigation into the diurnal variation of the body temperature of nocturnal and other birds, and a few mammals, S. SIMPSON and J. J. GALBRAITH (*Jour. Physiol., 33 (1905), No. 3, pp. 225-238, figs. 13*).—In birds of diurnal habit which were examined (chickens, ducks, pigeons, sea gulls, thrush, etc.), the mean body temperature for 24 hours, as shown by measurements made with a rectal thermometer, was practically the same for all species, namely, 41 to 42° C.

The range of temperature with different species was found to vary greatly, being least in the largest and greatest in the smallest birds. For example, in the domestic duck it was 0.92° and in the thrush 4.27°, while in the birds of intermediate size the range was also intermediate. When sex was considered, the mean temperature of females was found to be higher than that of males.

"The temperature curve of diurnal birds is essentially similar to that of man and other homœothermal mammals, except that the maxima occur earlier in the afternoon and the minima earlier in the morning.

"In nocturnal birds (owls), on the other hand, the curve is inverted, the maximum occurring about midnight or in the early morning and the minimum about noon or shortly after. As in diurnal birds, the temperature is highest during the natural period of activity (night) and lowest during the period of rest (day). The mean temperature is lower and the range less than in diurnal birds of the same size.

"The curves obtained from the rabbit, guinea pig, and dog show the same features as in man, with a few minor differences. Both the mean temperature and the range is less than in birds."

Incubation and incubators, R. H. WOOD (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 286-315, figs. 11*).—A summary of data regarding incubators in which different types of incubators are discussed, the defects of incubators pointed out, and methods of operating incubators and other related topics spoken of.

Incubation and incubators, R. H. WOOD (*U. S. Dept. Agr., Farmers' Bul. 236, pp. 31, figs. 11*).—A reprint of the article noted above.

The poultry industry of Petaluma, California, P. H. LAWLER (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 316–322, pls. 3*).—The author points out that the raising of chickens is not generally a paying business in California, except upon a strip 40 miles wide along the Pacific, though turkeys thrive in all parts of the State. Where practiced, however, the chicken industry is very important, and Petaluma may be fairly regarded as a center of the poultry industry.

Statistics regarding the poultry and eggs produced and shipped, the feeding and care of the poultry, and other similar data are summarized. The breeds of chickens which are more commonly raised in the vicinity of Petaluma are Barred Plymouth Rocks, Brown Leghorns, and White Leghorns, the last-mentioned breed far outnumbering all the others.

The growth of chickens, M. STEFANOWSKA (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 4, pp. 269–271; abs. in Zentbl. Physiol., 19 (1905), No. 16, pp. 581, 582*).—The rate of increase in weight of chickens on a uniform diet was found to progress rapidly until it reached a maximum, and then to take place less quickly. Some differences were noted with males and females, but in general the maximum rate of increase was about the middle of the growing period.

The Buff Orpington duck, D. F. LAURIE (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 2, pp. 85–90, fig. 1*).—The author considers Buff Orpington ducks very satisfactory for duck raising under local conditions, and records some data regarding egg yield. A bird under observation laid 79 eggs in 80 days; a second, 54 eggs in 54 days; a third, 92 eggs in 96 days; and a fourth, 70 eggs in 74 days.

The guinea fowl and its use as food, C. F. LANGWORTHY (*U. S. Dept. Agr., Farmers' Bul. 234, pp. 24, figs. 3*).—Data regarding varieties, habits and care, marketing guinea fowl, the value of their flesh and eggs as food, and similar topics are discussed. As pointed out, these birds are fairly hardy and will gather a considerable part of their food. The flesh is considered excellent, and there is a growing demand for guinea fowl at fair prices, particularly in city markets.

The oyster. A popular summary of a scientific study, W. K. BROOKS (*Baltimore: Johns Hopkins Press, 1905, 2. ed., pp. XVI+225, illus.*).—The principal object of this popular summary of data regarding the oyster and oyster problems, which is based largely on personal experience and observation, is to suggest means of conducting an oyster industry on a rational and economical basis.

The principal addition, in the second edition, the author states, is the section on the transmission of typhoid fever and cholera by oysters. If the micro-organisms causing these diseases and other similar minute forms of life pass into the oyster's stomach they are digested and rendered harmless, but as long as they remain in the gills they may be a possible source of infection if the oyster is eaten raw. The author believes that oysters should not be fattened or floated, but should be marketed directly from salt water.

"In my opinion, no one need fear to eat true salt-water oysters raw, but every fresh-water oyster and every 'fattened oyster' is too dangerous to be eaten raw. . . . [Fattened oysters are simply full of fresh water.] All the fresh water that a 'fattened' oyster has absorbed is at once extracted by cooking, so the 'fattening' of oysters that are to be cooked is not only an unnecessary expense, but a fraud on the consumer, who is sold filthy water from the harbors of cities at the price of oysters."

Imports and exports of animals and animal products, J. ROBERTS (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 469–505*).—A summary of statistical data.

The total value of animals and animal products imported into the United States in 1904 was $112,000,000 in round numbers. The total value of the exports was $249,300,000. The most prominent feature of our international trade in animals and animal products during the calendar year 1904 was a decided increase in imports.

Farm animals in 1904 (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 506–512*).—Statistics are given regarding the number and value of farm animals in the United States, the losses of farm animals during the year, and regarding the amount

and value of the wool products of 1903 and 1904. The total wool product for 1904 was estimated to be 291,783,032 lbs., and its value $64,940,959.

Live stock associations and the markets (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 513–558*).—Addresses and other data regarding live stock, registered stock, pedigree, and breeders' associations are summarized, and statistics given regarding the shipments of live stock and range of prices during the calendar year 1904.

DAIRY FARMING—DAIRYING.

Records of dairy cows in the United States, C. B. LANE (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 75, pp. 184, pls. 17, figs. 6*).—This is a compilation of authentic milk and butter records of pure-bred, grade, and native cows in this country to which numerous private records, having no official endorsement but believed to be reasonably accurate, are added.

In the introduction to the bulletin the author discusses the value of dairy records, methods of keeping records, and raising the standard of production, and in his summary draws conclusions along these lines from the data presented.

Circulars were sent to 600 dairymen making inquiries as to the management and production of their herds. Replies were received from over 200, and of this number 25 per cent stated that they did not keep records, while a still smaller proportion was able to give the cost of keeping their cows. Where a special breed was kept the reports indicated that the owners were more careful in the breeding and management of their cows and secured larger yields and greater profits. An abundance of nutrients returned the greatest profit over cost of food. The proportion of carbohydrates was often excessive. The silo assisted materially in reducing the cost of feed. The construction of stables was often faulty.

The author considers that the average production of dairy cows in this country is hardly up to the profit line and states the fundamental steps to be taken in improving dairy herds as follows:

"Take advantage of variation. While the tendency of nearly all cows raised is to become average cows, a number fall below and a few reach a yield of 500, 600, or even 700 pounds of butter.

"Those above the average should be carefully selected and bred with care and judgment.

"While the test must be used to detect variation and make selections, it is needed particularly to test the progeny, to determine whether the good qualities of the parent have been perpetuated, and to see if any improvement in the offspring has been made.

"Food, care, and management are of the highest importance. Having been carefully selected and having stood the test, the cows must be well fed and cared for if their good qualities are to be retained and improved."

The dairy industry in New Hampshire, I. C. WELD (*New Hampshire Sta. Bul. 120, pp. 69–80, figs. 4*).—This is a brief historical and statistical account of the dairy industry in the State.

The number of milch cows is placed at 129,900, and their average value per head at $32.34. It is estimated that the average cow produces annually 4,223 lbs. of milk. There are, in the State, 1 condensed milk factory, 7 cheese factories, 52 creameries, and 146 stations from which milk is shipped to Boston.

Demonstration experiments on the feeding of dairy cows, conducted at the expense and under the supervision of the government during the winter of 1904-5 (*Bul. Agr. [Brussels], 21 (1905), No. 5, pp. 691–872*).—This is a detailed report of experiments carried out in the different provinces of Belgium in the same manner as in previous years (E. S. R., 16, p. 1010). Conclusions are drawn

from the results of individual experiments, which are very numerous, but not from the work as a whole.

Report of the Brown Swiss Cattle Breeders' Association, 1904 (*Landw. Jahrb. Schweiz, 19 (1905), No. 7, pp. 447-476*).—In this report are included the records of a number of cows of the Brown Swiss breed. The average annual yield of milk of 28 cows was 4,001.4 kg., the average percentage of total solids was 12.94, and of fat 3.81. Similar data for the previous year were noted in E. S. R., 16, p. 698.

Report of the Spotted Swiss Cattle Breeders' Association, 1904, (*Landw. Jahrb. Schweiz, 19 (1905), No. 6, pp. 301-337*).—The average annual yield of 61 cows of this breed was 3,798 kg. of milk, showing an average fat content of 3.85 per cent and 12.97 per cent total solids.

On the importance of a careful system of milking, H. P. LARSEN (*Ugeskr. Landm., 51 (1905), No. 50, pp. 555, 556*).—The results of the introduction of contract milking at a Danish estate are given. The average production of 43 cows the first year, when payment for the milking was based on the amount of butter fat obtained in the milk, was 6,925 Danish pounds milk and 267 lbs. fat (average per cent fat, 3.47), against 5,689 lbs. milk and 222 lbs. fat (average per cent fat, 3.48), during the preceding year. The system of feeding, care, and management of all the cows included in this summary, aside from the method of paying for the work of milking, was the same both years.—F. W. WOLL.

The consumption of milk in the city of Antwerp and its suburbs, F. SMEYERS and E. WEYNANTS (*Rev. Gén. Agron., 14 (1905), No. 10-11, pp. 417-428*).—The total milk consumption of the 371,000 inhabitants was 82,830 liters per day, of which 68,000 liters was fresh whole milk, 1,800 liters whole pasteurized milk, 3,725 liters milk partially skimmed, 7,070 liters skim milk, and 2,235 liters whipped milk.

Is the composition of milk influenced by the food? O. JENSEN (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 534-559; Rev. Gén. Lait, 5 (1905), Nos. 5, pp. 103-110; 6, pp. 121-128; 5 (1906), Nos. 7, pp. 152-161; 8, pp. 178-185; 9, pp. 198-205*).—This is a continuation of similar investigations previously noted (E. S. R., 16, p. 1009).

The following methods of feeding were studied as regards their influence upon the composition of milk: (1) The addition of different mineral salts to forage composed of hay and aftermath or of grass, (2) feeding decreasing quantities of hay in connection with increasing quantities of peas, by which method the chlorin and alkalies were increased and the phosphoric acid and alkaline earths decreased, (3) feeding increasing quantities of sesame cake and wheat bran with a basal ration consisting of hay, by which method the reverse of the above was secured, and (4) feeding grass from unfertilized meadows and from meadows fertilized in different ways. The detailed report of the investigations contains a description of the methods of analysis employed, a discussion of the influence of lactation on the milk, and the results of the methods of feeding mentioned.

When large quantities of saltpeter were fed the milk showed a trace of nitrate. Large quantities of roots increased the volatile fatty acids. Feeding sesame cake in connection with wheat bran increased the oleic acid content of the milk fat. Feeding stuffs rich in organic phosphorus compounds increased the acidity and the phosphorus content of the milk to a slight extent. Grass very poor in alkalies and phosphoric acid decreased slightly the potassium in the milk and to a more marked extent the acidity of the milk and also decreased the curdling power of the milk with rennet. By changing to green food and also in some cases on pasture the acidity of the milk was increased.

From these results it is concluded that the composition of the milk fat and the natural acidity of the milk may be influenced by means of food and other conditions and that the quantity of certain inorganic milk constituents can be increased or decreased in very extreme cases by feeding, but only within very narrow limits. On the whole the results showed that the composition of milk is not readily influ-

enced by feeding and that it is, therefore, no difficult matter to so use artificial fertilizers and concentrated feeds that no injurious effects upon milk and cheese may result.

Lactic acid in cows' milk, O. H. Nowak (*Amer. Food Jour., 1 (1906), No. 1, pp. 21, 22*).—The author calculates that there is present in milk serum a quantity of organic acid equivalent to 2.5 gm. of citric acid per liter.

The content of preformed sulphuric acid in cows' milk, R. Steinegger and O. Allemann (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, p. 530*).—The analyses made by the authors showed the presence in solution of 0.0823 to 0.1311 gm. of SO_3 per liter. The authors conclude, therefore, that there can no longer be any doubt as to the presence of preformed sulphuric acid in cows' milk.

Contribution to the knowledge of the properties of salty, bitter milk, R. Steinegger and O. Allemann (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 531–533*).—Milk having a salty, bitter taste is often obtained from cows having a disease of the udder. The authors analyzed a number of such samples and found that the percentages of fat and sugar were greatly reduced. The percentages of ash also showed considerable variations from normal. In general, there was a decrease in P_2O_5, CaO, K_2O, and MgO and an increase in Cl, Na_2O and SO_3.

The viscous fermentation of milk and beer, F. C. Harrison (*Rev. Gén. Lait, 5 (1905), Nos. 4, pp. 73–80; 5, pp. 97–103; 6, pp. 129–136; 5 (1906), No. 7, pp. 145–152*).—The literature of slimy fermentations in milk is reviewed and a bibliography of this subject is given. In addition the author reports in detail studies of 12 species of slime-producing organisms, some of which were isolated by himself.

While the investigations are not as yet complete the author feels justified in concluding that the bacillus isolated from slimy milk by Marshall and the bacillus isolated by Ward are identical with the *Bacillus lactis viscosus* of Adametz. The 12 species were divided into four groups, of which the different members were considered as identical. This division was based upon the morphological and cultural characteristics. The author also studied the nature of the viscous substance formed in such fermentations, and concluded that the viscosity is not produced by a diffusible enzym produced by the micro-organisms, but that the viscous substance is intimately associated with the substance of the micro-organisms.

An experimental investigation of the Budde process for the preservation of milk, R. T. Hewlett (*Lancet [London], 1906, I, No. 4, pp. 209–211*).—The author believes that in hot weather much of the milk delivered in London would be unusable except for the addition of preservatives. While he does not advise their addition he considers that under present conditions the moderate addition of preservatives is less dangerous than a semiputrid milk. The Budde process of treating milk is described and some investigations are reported.

In testing the efficiency of the Budde method, milk was cooled at the dairy immediately after milking and shipped to the laboratory, where it arrived after 4 or 5 hours. Emulsions of cultures of various micro-organisms were added to samples of the milk and treated by the Budde method. Samples were also subjected to the same amount of heat without the addition of hydrogen peroxid, and noninoculated samples were also used as controls.

The organisms tested were *Bacillus diphtheriæ*, *B. acidi lactici*, *B. coli*, *B. typhosus*, paratyphoid bacillus, *B. dysenteriæ*, cholera vibrio, *Micrococcus pyogenes aureus*, *B. tuberculosis*, *B. anthracis* with spores, *B. subtilis*, *B. mycoides*, and *Penicillium glaucum.*

From one to three experiments were made with each organism. The results showed that all the nonsporogenous organisms, both pathogenic and nonpathogenic, were destroyed by the Budde process. The spore-bearing organisms, while not destroyed, were greatly reduced in numbers. The reduction in numbers of organisms by heating alone was not so great as that by the Budde method. In milk

obtained in the ordinary way the number of micro-organisms were reduced by the Budde method over 99.9 per cent.

The author states that milk treated by the Budde method is practically undistinguishable from untreated milk in taste, odor, and appearance and in the rising of the cream, and that such milk will keep perfectly sweet and apparently unaltered for at least 8 to 10 days in hot weather and for a still longer period in cold weather. No increase in acidity is caused by the treatment, and when properly carried out the whole of the hydrogen peroxid is decomposed, and hence at the end of the process no trace of it can be detected in the milk.

The detection, determination, and rate of disappearance of formaldehyde in milk, R. H. WILLIAMS and H. C. SHERMAN (*Jour. Amer. Chem. Soc., 27 (1905), No. 12, pp. 1497–1503*).—The hydrochloric-acid and ferric-chlorid test for formaldehyde in milk was found very satisfactory. Souring of the milk did not in itself affect the delicacy of the test. The gallic-acid test has been found considerably more delicate, but less convenient. The potassium-cyanid method was found satisfactory for quantitative determinations at any concentration greater than 1 to 160,000.

Aqueous solutions of formaldehyde containing 1:5,000 to 1:40,000 of formaldehyde lost strength steadily on standing at room temperature, the loss increasing with the dilution, and due to an actual destruction of the formaldehyde. When added to milk in the proportions of 1:10,000 to 1:40,000 formaldehyde disappeared from 10 to 20 times as rapidly as from aqueous solutions of this same concentration. In aqueous solution formaldehyde decreased in amount from 1:40,000 to 1:160,000 in 28 days, while in milk the same diminution occurred in 2 days. Aqueous solutions of 1:1,000 showed no appreciable loss in 5 months. The rate of disappearance from milk was practically the same, whether formaldehyde was added before or after souring.

Contribution to the knowledge of the influence of formaldehyde upon milk, R. STEINEGGER (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 512–527, fig. 1*).—The author studied the influence of formaldehyde on the milk fat, milk sugar, action of rennet, and the acidity of milk. Some of the conclusions reached follow:

Formaldehyde when added to milk exerts an influence upon the proteids which is not dependent upon the presence of any organic ferment. Formaldehyde increases the acidity of the milk. Each milk is capable of combining with only a definite quantity of aldehyde which so-called aldehyde number stands in direct relation to the nitrogen, the greater the amount of nitrogen the higher the aldehyde number. This reaction is not influenced by the action of rennet or the decomposition of milk due to long keeping. Formaldehyde increases also the acidity in ripe cheese.

The influence of formaldehyde on proteids, R. STEINEGGER (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 528, 529*).—In connection with the above investigations the author studied the influence of formaldehyde upon leucin and tyrosin, concluding that formaldehyde and other aldehydes are capable of entering into combinations with the amido bodies.

The possible infection of man with Micrococcus melitensis by goats' milk (*Jour. Roy. Army Med. Corps, 6 (1906), No. 1, pp. 113–116*).—An outbreak of Malta fever on shipboard is attributed, in the correspondence here given, to the drinking of the milk of goats.

On the injurious effects of sterilized milk on the nutrition of infants, A. KARAWJA (*Abs. in Chem. Ztg., 29 (1905), No. 94, Repert. No. 24, p. 353*).—The results of the author's investigations are unfavorable to the use of sterilized milk in infant feeding.

Principles and practice of butter making, G. L. MCKAY and C. LARSEN (*New York: John Wiley & Sons; London: Chapman & Hall (Ltd.), 1906, pp. XII+329, pls. 6, figs. 172*).—As the subtitle reads, this is a treatise on the chemical and physical properties of milk and its components, the handling of milk and cream, and the manufacture of butter therefrom.

The authors state that they have endeavored to incorporate the best and most progressive methods employed in butter making in the principal dairy countries of the world, and to give such related scientific information as may be of interest and value.

The scope of the treatise is indicated by the chapter headings, which are as follows: Composition of milk; milk secretion; properties of milk; ferments in milk; abnormal milk; variation of fat in milk; receiving, sampling, and grading milk and cream; composite samples; creamery calculations; heating milk previous to skimming; separation of cream; farm separators; pasteurization; cream ripening; starters; churning and washing butter; salting and working of butter; packing and marketing butter; composition of butter, and judging and grading butter. The book is well printed and illustrated.

Contribution to the knowledge and determination of volatile fatty acids in palm oils and butter, O. JENSEN (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 477–495; Ann. Agr. Suisse, 6 (1905), No. 6, pp. 224–246; Rev. Gén. Lait, 4 (1905), No. 19, pp. 437–447; 20, pp. 457–464; 21, pp. 481–490; abs. in Jour. Soc. Chem. Indus., 24 (1905), No. 19, pp. 1025, 1026*).—The author separated the volatile fatty acids of cocoanut oil and butter by the fractional precipitation of their silver salts, and studied their properties.

Cocoanut oil was found to contain no butyric and but little caproic acids, while the percentages in butter, though varying greatly with different samples, were on an average 3.92 per cent for butyric and 1.88 per cent for caproic. For the detection of small quantities of cocoanut oil in butter the determination of caprylic and capric acids is recommended.

A marked case of late gassy fermentation in cheese, A. PETER and M. SCHNEEBELI (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 19–20, pp. 600–605, pls. 2*).—From a series of 24 Emmenthal cheeses which showed gassy fermentation after 10 to 14 days the authors isolated a variety of *Bacterium lactis aerogenes* which was often present in nearly pure cultures and which was considered the probable cause of the trouble. A similar result was obtained in the manufacture of an experimental cheese in which this organism was used in a pure culture.

On the influence of lactic acid on casein and paracasein, O. LAXA (*Milchw. Zentbl., 1 (1905), No. 12, pp. 538–547*).—The author concludes from the results of his investigations that casein combines with lactic acid to form lactates.

The lactates which contain lactic acid up to 1 per cent are insoluble in water, while the lactates with higher acid contents are soluble in water. By dialysis a lactate may be obtained which contains from 1.4 to 1.9 per cent of lactic acid. By precipitation with mineral salt from a solution of casein in lactic acid a lactate may be obtained which contains 7.5 per cent of acid. It is, therefore, considered that the designation of the insoluble lactate as mono-lactate and the soluble lactate as di-lactate by Van Slyke and Hart (E. S. R., 14, p. 607) is unsatisfactory. [It may here be noted that the more recent investigations of Van Slyke and Hart (E. S. R., 16, p. 1018) have shown, according to these authors, that there is only one series of casein compounds formed by a combination with acids, and that what they previously supposed was a casein mono-salt was simply the base-free casein.]

Casein lactates contain only a small amount of phosphorus, 0.45 to 0.48 per cent. The spontaneous curdling of milk is explained by the formation of lactic acid by means of micro-organisms, the changing of the phosphates of milk into acid salts by means of the lactic acid, the formation in the milk of both soluble and insoluble lactates, and when the soluble lactates are present in sufficient quantities the precipitation of them by the mineral salts as curd. The high plasticity of the casein in cheese is due to the impregnation of the casein with calcium lactate. It is considered probable that paracasein is a combination of casein with calcium phosphates. By the influence of acids the paracasein is changed into casein and forms the same lactates as the casein.

New industrial product, R. GUENTHER (*Mo. Consular and Trade Rpts.* [*U. S.*] *1905, No. 302, p. 243*).—Brief reference is made to the manufacture of galalith, a horn-like product prepared from cows' milk, and stated to be valuable in the manufacture of various ornamental and useful articles.

Officials, associations, and educational institutions connected with the dairy interests of the United States for the year 1905 (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 80, pp. 12*).

VETERINARY MEDICINE.

Report of the Minnesota State Live Stock Sanitary Board, 1905, S. H. WARD ET AL. (*Ann. Rpt. Minn. Live Stock Sanit. Bd. 2* (*1905*), *pp. 119*).—Within recent years wheat has been less extensively planted in Minnesota than formerly, and animal industry has assumed greater importance. This statement is particularly true for dairying. The work of the live stock sanitary board has increased in value correspondingly.

Certain dairymen have raised objection to the inspection of cattle for tuberculosis and testing them with tuberculin. The test is not made compulsory, however, unless the disease is known to exist in the herd. On account of the fact that an indemnity is paid owners for the destruction of tuberculous cattle, it is recommended that such dairymen be not allowed to replenish their herd with other cattle without previous inspection. Otherwise the reimbursement for other animals would constitute a continual burden on the State.

Glanders appears most frequently in the counties adjacent to the Dakotas, and outbreaks are usually traced to the purchase of range horses. Considerable work has been done during the year on hog cholera, particularly with reference to the existence of a form of the disease caused by filterable virus, as described by the Bureau of Animal Industry of this Department. Notes are also given on swamp fever, rabies, and blackleg. W. L. Beebe presents a detailed report on the pathology and bacteriology of tissues and material sent to him during the year for examination.

Human and bovine tuberculosis, N. RAW (*Brit. Med. Jour., 1905, No. 2338, pp. 1018–1021*).—The views at present held by the author on the relationship between these two forms of tuberculosis are based on an observation of 3,500 cases of human tuberculosis and a study of 650 autopsies.

During these investigations it was found that the lungs of children may become infected by direct extension of infection from the mesenteric glands through the diaphragm to the lungs. This infection frequently follows the use of tuberculous milk. The author maintains that human and bovine tuberculosis are distinct diseases, and are capable of setting up different sets of symptoms at different periods of life, depending upon the localization of infection, and that primary intestinal tuberculosis is generally bovine in origin from infected milk. According to this view of the matter, therefore, human and bovine tubercle bacilli are distinct species, but man is susceptible to both.

The origin of pulmonary lesions in tuberculosis, H. VALLÉE (*Ann. Inst. Pasteur, 19* (*1905*), *No. 10, pp. 619–624*).—It appears to be established beyond controversy that in all species of animals the pulmonary parenchyma is the favorite tissue for the location of the tubercle bacillus.

In statistics collected on 43,000 animals the lungs were affected in 75 per cent of cases. The author inoculated 2 young calves by the intratracheal method and found that the lungs as well as the bronchial and mediastinal glands were difficult to infect in this way. Experiments were also carried out which seemed to indicate that the lungs may readily become affected by extension of an alimentary infection.

As a result of his investigations the author concludes that among the various methods of infection that of ingestion is calculated to produce most surely and most

quickly an infection of the lymphatic glands in the region of the lungs. The tubercle bacillus, introduced into the intestines, seems to be able to pass through the intestinal walls and the neighboring lymphatic glands without leaving any trace of its presence.

Intestinal origin of pulmonary tuberculosis, A. CALMETTE and C. GUÉRIN (*Ann. Inst. Pasteur, 19 (1905), No. 10, pp. 601–618*).—The investigations reported in this paper were undertaken for the purpose of obtaining information regarding the proposition of von Behring that pulmonary tuberculosis usually arises as the result of intestinal infection in early life. For this purpose the authors experimented with goats, testing the effect upon this animal of ingestion of tuberculous products of various origin.

It was found possible to infect the mammary gland of goats with cultures of bovine, human, and avian tubercle bacilli as well as with those of pseudotuberculosis. Even when the tissue of the gland was in no way injured, cultures of bovine tubercle bacilli introduced into it led to the death of the animal within a short time and without extension of the lesions to any other organ. Cultures of human tubercle bacilli, however, were less virulent and produced lesions which slowly healed. The avian bacillus and the bacillus of pseudotuberculosis were less virulent.

Young goats were then allowed to suck milk from mammary glands infected in the manner just described. From these experiments it appears that young goats react in a decided manner to any of the cultures already mentioned obtained in the milk of infected goats. The reaction was most pronounced in the mesenteric glands. In all cases, without regard to the kind of bacillus, these glands became greatly swollen, but only the bovine and human tubercle bacilli led to the actual formation of tubercles within the ganglia. The bovine bacillus caused the most serious infection, leading to caseation of the tubercles and ultimately extending to the lungs. After infection with the human bacilli, however, the lesions tended to heal by calcification.

Detailed notes are given on the post-mortem findings in young goats treated in the manner indicated. Cultures of the same species of bacilli were then introduced by means of a sound directly into the rumen of other young goats. In these experiments also the bovine bacillus was most virulent, producing secondarily a pulmonary infection. Human bacilli appeared to be harmless for young goats when introduced directly into the rumen and did not exercise a vaccinating effect toward bovine bacilli. Avian bacilli and bacillus of pseudotuberculosis were equally harmless.

In the first experiments carried out by the authors, an apparent confirmation of von Behring's theory was found. Later, however, experiments showed that von Behring's theory that pulmonary tuberculosis of the adult results from a slow development of an intestinal infection in early life is probably wrong. According to the authors' experiments in adult goats, the infection proceeds more easily from the intestines to the lungs than in early life.

Danger of infection with tuberculosis by different kinds of exposure, E. C. SCHROEDER and W. E. COTTON (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 44–65*).—In determining the relative liability of infection from different methods of exposure the authors subjected guinea pigs to infection from abdominal injections of milk from tuberculous cows, from feeding tuberculous milk, being confined in cages on the walls of stalls in which tuberculous cattle were kept, or in the mangers of such cattle.

The milk used for intraabdominal injections came from 6 tuberculous cows, and 224 guinea pigs received injections of such milk. Of this number 4, or 1.78 per cent, became infected. The total amount of milk used in these injections was about 3 pts. The number of guinea pigs fed tuberculous milk was 132, and of this number 1, or 0.76 per cent, became infected. The total amount of milk fed was about 118 gal. and the average feeding period about 47 days. The number of guinea pigs exposed in the same stall with tuberculous cows was 35, and of this number 2, or

5.71 per cent, became tuberculous after an average exposure of 135 days. During the same time 42 guinea pigs were exposed in the mangers of the same cows, and of this number 6, or 14.28 per cent, were infected.

A series of experiments was also carried out on 19 hogs, which were fed in all 462½ gal. of tuberculous milk during an average feeding period of 143 days. None of the pigs became infected.

Comparing intraabdominal injections of tuberculous milk with ingestion of the same product, it was found that the latter method required 12,000 times as much milk as the former to produce an infection These experiments are believed to show that while the milk of tuberculous cows is a dangerous product, the liability to infection from it is much less than from other sources of infection. Attention is called to the fact that not one of the 132 guinea pigs injected with milk from one of the cows which was badly affected with tuberculosis developed the disease.

Clinical and bacteriological diagnosis of bovine tuberculosis, J. VENNERHOLM (*Svensk Vet. Tidskr., 10 (1905), No. 11, pp. 444–451*).—Particular attention is given in this review to a consideration of the investigations of Ostertag and his associates on the means of diagnosing various forms of tuberculosis, especially mammary tuberculosis.

The tuberculin test for tuberculosis, D. E. SALMON (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 79, pp. 14*).—This circular is a reprint from the Yearbook of the Department for 1901 (E. S. R., 14, p. 396).

Vaccination against tuberculosis, THOMASSEN (*Tijdschr. Veeartsenijk., 33 (1905), No. 3, pp. 151–162*).—The literature relating to this subject is briefly discussed.

The author experimented with young calves to determine suitable methods of immunizing them against tuberculosis. For this purpose cultures of human tubercle bacilli, serum from hyperimmunized cattle, tuberculin, and bovovaccine of von Behring were tested. As a result of the author's experiments it is concluded that active immunity toward tuberculosis may be brought about in young calves.

The author recommends that calves should be vaccinated at the age of about six weeks before exposure to tuberculosis and only after a negative result from tuberculin test. The use of human tubercle bacilli of low virulence is preferred to that of other vaccines or serums. Special care is urged in pulverizing the bacilli in order to prevent possible pulmonary lesions in the young calves. The degree of immunity is not definitely determined. The author believes that the method will suffer from certain practical difficulties when applied on a large scale.

The development of tubercular mammitis, G. MOUSSU (*Rec. Méd. Vét., 83 (1905), No. 23, pp. 777–788, pls. 2, figs. 2*).—Attention is called to the fact that the large percentage of tuberculosis observed in hogs fed on dairy by-products around creameries and cheese factories has been greatly reduced as the direct result of sterilizing these products.

The author insists that it is not sufficient to regard the milk merely from cows affected with tuberculosis of the udder as infectious. From his own observations combined with those of others he believes that the milk of all tuberculous cows must be considered as dangerous. It is granted that frequently, perhaps in the majority of cases, the milk of tuberculous cows in which the udder is not affected does not contain enough tubercle bacilli to produce infection. The fact can not be determined, however, from an external examination of the cow, and the milk is, therefore, to be suspected.

In order to prevent the distribution of tuberculosis by means of tuberculous milk, it is recommended that all tuberculous cows be excluded from herds which furnish milk for the public. On account of the difficulty of carrying out such measures at once it is recommended that temporarily the milk of tuberculous cows be sterilized or otherwise treated so as to destroy the tubercle bacillus before distributing for use.

Contagious mammitis, G. MAYALL (*Vet. Rec., 18 (1905), No. 910, p. 414*).—In

cases of contagious mammitis the author reports good success from the use of an ointment consisting of equal parts of lanolin and lard mixed with ½ dr. each of calomel and carbolic acid for every 2 oz. of the base. The external lesions in bad cases of contagious mammitis are perhaps irritated to considerable extent by milking. The use of a milking siphon, however, in such cases seems to be a doubtful procedure, for the reason that the infection might be thereby spread.

Abortion and sterility in cows, J. A. GILRUTH (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 4, pp. 255–261*).—These diseases, though usually separated, are in reality closely associated and cause great losses annually in South Australia.

The symptoms and means of dissemination of this disease are described. The method of procedure in treating cows consists in the free use of antiseptics. During the past 3 years several thousand cows have been treated with antiseptic washes of corrosive sublimate and almost uniformly the results have been satisfactory.

Hemorrhagic enteritis of cattle, CHAUSSE (*Rec. Méd. Vét., 83 (1905), No. 23, pp. 788–795*).—From the accounts of various investigators relating to this disease it appears that it is not always due to the same cause. The various forms of the disease are briefly described and notes are given on the pathological lesions. No satisfactory treatment has been devised. In a few cases hypodermic injections of ergotine in doses of 0.5 to 3 gm. daily have proved efficacious.

Contagious conjunctivitis of cattle, F. A. VERNEY (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 11, pp. 1079, 1080*).—This disease usually affects young calves, but sometimes occurs among adult animals. The symptoms are briefly described. It is evidently contagious, and diseased animals should, therefore, be quarantined. As a direct treatment for the eye, the author recommends a solution of nitrate of silver and extract of belladonna containing 8 grains each to an ounce of water.

Contagious pleuro-pneumonia, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 27 (1905), No. 6, pp. 756–773*).—According to the observations of the author the period of incubation of the disease ranges from 42 to 59 days, and death occurs within from 17 to 33 days after the disease appears.

The symptoms and post-mortem lesions are described in detail. In securing virus for use in preventive inoculation an animal in the first stages of the disease should be selected and killed. The pleural fluid may then be removed under aseptic conditions and used for inoculation of healthy animals. Inoculation does not always render animals immune. In some cases the vaccine does not appear to take.

The author found that the pleural fluid could also be used successfully in preventing the disease when applied as a drench. In this operation the fluid should be collected in a careful manner and strained, after which it is given as a drench without the addition of water. Care should be exercised not to cause any abrasion of the mucous membranes during the operation, since otherwise a fatal infection may take place.

Experiments with septicidin in septic pleuro-pneumonia of calves, EBERHARD (*Berlin. Tierärztl. Wchnschr., 1905, No. 49, pp. 829, 830*).—On account of the prevalence of this disease and the difficulty of eradicating it by ordinary means, the author tested septicidin for this purpose.

During one outbreak of the disease the author vaccinated 15 calves. Each calf received 10 cc. of the septicidin hypodermically. None of the vaccinated calves became infected. The same remedy was tested on another estate with equally satisfactory results. It was not used for curative purposes.

Epizootic lymphangitis, S. T. AMOS (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 10, pp. 993–996, pl. 1*).—Infection from this disease usually takes place through skin wounds chiefly on the ribs and flank, but also on the fore limbs.

The post-mortem appearances of the disease are described and notes are given on the treatment. In cases which have been allowed to run for a long time without

care there is no hope of cure. In the early stages, however, a recovery may be brought about by the application of an ointment of biniodid of mercury.

Bacillus necrophorus and its economic importance, J. R. MOHLER and G. B. MORSE (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 76-116*).—An elaborate review is presented of the synonymy, history, and literature of this bacillus in connection with the bibliography of related articles.

The organism occurs normally in the intestines of hogs and perhaps also of the cow and horse. Notes are given on its morphology, motility, staining, biology, behavior on different culture media, and chemical activities. It is destroyed by exposure to a 2 per cent solution of carbolic acid for 2 minutes, a 1/2000 solution of bichlorid of mercury for 9 minutes, or a 1 per cent formaldehyde solution for 13 minutes. The authors described in detail the pathogenic properties of this organism and the special pathology as shown in cases of necrobacillosis of the skin in rabbits, guinea pigs, and other animals, and also in the hoof and digestive tract.

An account is also presented of other diseases caused by the necrosis bacillus, such as necrotic stomatitis, ulcerative anovulvitis, necrotic vaginitis, necrotic metritis, foot rot of cattle and sheep, joint ill, avian diphtheria, etc. The deep ulcers in the intestines in cases of hog cholera are apparently due to the necrosis bacillus, and the organism has also been isolated from chickens affected with diphtheritic roup as well as other birds. As a prevention against this organism the authors recommend the thorough application of antiseptics.

Poisoning of cattle by molds, BAYER (*Wchnschr. Tierheilk. u. Viehzucht, 49 (1905), No. 50, pp. 793, 794*).—The author presents some of the details of symptoms and pathological lesions observed in 5 cattle which were affected by eating clover badly damaged by certain common molds, especially *Aspergillus glaucus* and *Penicillium glaucum*. The symptoms were great weakness, reddened mucous membrane of the mouth, loss of appetite, paralysis of the throat, and diarrhea.

Enzyms in cornstalks and their relation to cornstalk disease, T. M. PRICE (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 66-75*).—On account of the suddenness with which death occurs in many cases of so-called cornstalk disease, it was suspected that the presence of prussic acid in cornstalks might be the cause.

Cornstalks were obtained from a field where a number of cattle had died of cornstalk disease, but upon direct analysis for prussic acid this poison could not be determined. Negative results were also obtained from an attempt to find a glucoside which might break up into prussic acid. Attention was then directed to the possible presence of enzyms, and a peroxydase was found with the properties of catalase. Further analyses showed that neither diastase, invertase, lactase, maltase, cytase, or lipase were present. The cornstalk enzym lost its power of splitting up glucoside when subjected to a temperature of 78° C. The proteolytic enzym was broken up at 68° C. The cornstalk enzym appeared to have the same resisting power toward heat as that obtained from bitter almonds.

The author believes that these investigations, while not conclusive, indicate the presence of an enzym in cornstalks which may give rise to the formation of prussic acid by splitting up glucosides. This would account for a certain percentage at least of the cases of cornstalk disease.

A recent outbreak of sheep pox, TEETZ (*Berlin. Tierärztl. Wchnschr., 1905, No. 49, p. 830*).—In outbreaks of this disease it is recommended that a strict quarantine be enforced, so that healthy animals may not be exposed to the disease. When quarantine is maintained with sufficient stringency it is possible to make incisions in the swollen parts of the skin in infected sheep and treat the wounds so that the mortality is reduced to a very low percentage.

Report of the work against scabies of sheep and cattle in 1904, C. O. GOODPASTURE (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 447-460*).—During

the year under report there has been a decided reduction in the number of scabby sheep received at the principal market centers, and this reduction is attributed to the greater restrictions on the traffic of sheep without inspection.

The number of scabby sheep received at regular stations in 1904 was 85,221. During the same year the total number of sheep inspected was 43,000,000, of which 3,000,000, or 7.4 per cent, were infected. The total number of sheep dipped was more than 12,000,000, of which 2,000,000 were dipped the second time. The percentage of effectiveness was 99.35. Special attention is called to the very successful work in the eradication of sheep scab in Utah and Wyoming, where the results are largely due to the thorough and satisfactory cooperation between the State and Federal authorities. Such cooperation has also been arranged in New Mexico and other infected districts.

The woolgrowers of the Western States have come to realize the importance of drastic measures in dealing with sheep scab. During the year 1904 the number of scabby cattle received at regular market centers was 19,702. The total number of cattle inspected during the same year was 8,395,000, of which 230,000 were scabby. The total number of cattle dipped during the year was 564,000, including 169,000 which were dipped twice.

Hog cholera, W. ROBERTSON (*Agr. Jour. Cape Good Hope, 27 (1905), No. 6, pp. 735–746, pls. 2*).—The history of this disease in South Africa is outlined in considerable detail, and notes are given on the symptoms and post-mortem lesions, especially as observed by the author in South Africa.

In general, the pulmonary lesions appear to be quite constant and occur independently of the intestinal ulcers. Directions are given for disinfecting premises after the occurrence of the disease, and on other methods for preventing the disease by means of quarantine and isolation of affected hogs.

The use of mallein in diagnosing glanders, L. J. HOOGKAMER and J. DE HAAN (*Tijdschr. Veeartsenijk, 33 (1905), No. 3, pp. 169, 170*).—As a result of extensive mallein tests carried out since 1896 the authors conclude that glanderous horses should ordinarily show a reaction of 1½ to 2° C. after inoculation with mallein. The temperature of healthy horses should not rise above 38.4° C. after inoculation.

Dog distemper, PIORKOWSKI (*Berlin. Tierärztl. Wchnschr., 1905, No. 49, pp. 830–832*).—Much attention has been given to a study of the bacteriology of this disease.

The author isolated several bacteria from cases of dog distemper and finally found a virulent organism in the spleen, lungs, and hypophysis of the brain. This organism in pure cultures produced death from typical dog distemper within 2 to 3 weeks after the inoculation of healthy dogs. From this organism a serum was obtained through culture and inoculation experiments which produced satisfactory results in 83 per cent of cases. The author believes, therefore, that this serum may be relied upon in preventing the development of dog distemper.

Fowl cholera, C. H. STANGE (*Iowa Agr., 6 (1905), No. 3, pp. 86–88*).—The symptoms of this disease are briefly described.

Since treatment is ordinarily ineffective, it is necessary to adopt preventive measures. To this end poultry houses in which an outbreak of the disease has occurred should be treated with carbolic acid or some other antiseptic, and dead or diseased fowls should be disposed of by burning or burying deeply. In order to prevent the spread of infection to healthy fowls, corrosive sublimate may be placed in the drinking water at the rate of 1 part in 2,000.

Animal parasites affecting domesticated animals, DESMOND (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 4, pp. 247–255, figs. 9*).—Notes are given on certain tapeworms which infest horses, including *Tænia perfoliata*, *T. plicata*, and *T. mamillana*.

In preventing infestation by these parasites attention should be given to the water supply, since horses may become infested from contaminated water. The water may be treated with sulphate of iron. Santonine and tartar emetic may be

added to the food. A peculiar case of intestinal infestation in a horse is reported. The larvæ of botflies were found attached in considerable numbers to *Ascaris megalocephala* and tapeworms in the intestines of the horse.

Treatment for worms in domestic animals, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 27 (1905), No. 5, pp. 589–614, figs. 20*).—Particular attention is given to treatment of domesticated animals for tapeworms, roundworms in horses, and stomach worms of sheep.

Sulphate of copper is said to be one of the longest used and most effective remedies for roundworms in horses. It also gives good results in the treatment of stomach worms in sheep and tapeworms in calves, lambs, and kids. During experiments in drenching animals with a solution of sulphate of copper, it was found that goats were more resistant to this drug than sheep. Goats were given as much as 40 grains sulphate of copper and 4 oz. of water without harm, no inflammation being caused in the mucous membrane of the stomach. In the preliminary experiments with sulphate of copper in treating lambs, however, numerous cases of the poisonous effects of this substance were seen and many deaths were caused.

After further experimentation it was decided that copper sulphate to be used for such work should be of standard purity of a uniform dark blue color. It appears that a fast of more than 30 hours renders sheep more susceptible to the influence of copper sulphate than they otherwise would be. The author recommends that 1 lb. of copper sulphate be dissolved in 10 gal. of water, and that from this solution 1½, 3, 3½, 4, and 5 oz., respectively, be fed to lambs 3, 6, 9, 12, and 18 months old.

Numerous experiments were carried out in treating ostriches for infestation with *Srtongylus douglassii*. As a result of these experiments it was found that a preliminary dose of kerosene oil tends to remove gastric mucus caused by the presence of parasitic worms. The parasites are then more directly exposed to the action of carbolic acid and turpentine, which are recommended in destroying these worms. The method of procedure recommended by the author is as follows: After fasting 18 hours give 12 oz. of kerosene and an equal quantity of milk to adult birds. After 2 or 3 days allow the birds to fast again for 18 hours, after which they are to be given 4 dm. carbolic acid and 12 dm. of turpentine in 10 oz. of water.

The tapeworms of American chickens and turkeys, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 268–285, figs. 31*).—In this article the author presents complete descriptions of all species of tapeworms known to occur in chickens and turkeys in the United States. A key is also given to assist in their identification and brief notes are presented on the life history of the tapeworm and means of eradicating them.

Contagious diseases of animals in foreign countries, J. ROBERTS (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 461–468*).—Statistics are presented on the extent of the more important infectious diseases in Belgium, Denmark, France, Germany, Great Britain, Hungary, Netherlands, Norway, and Sweden.

The exhibit of the Bureau of Animal Industry at the Louisiana Purchase Exposition, J. M. PICKENS and J. W. FINK (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 406–416, pls. 2*).—A brief account is presented of the exhibit made by the Bureau at the St. Louis Fair with particular reference to meat inspection, stock inspection, discussion of animal diseases, horseshoeing, dairy industry, and animal husbandry.

RURAL ENGINEERING.

Report of irrigation and drainage investigations, 1904 (*U. S. Dept. Agr., Office Expt. Stas. Bul. 158, pp. 755, pls. 12, figs. 129*).—This is the fifth annual report of the investigations in these lines carried on by this Office.

The report contains the following articles: Review of the Irrigation Work of the Year, by R. P. Teele; Irrigation in Santa Clara Valley, California, by S. Fortier;

The Distribution and Use of Water in Modesto and Turlock Irrigation Districts, California, by Frank Adams; Relation of Irrigation to Yield, Size, Quality, and Commercial Suitability of Fruits, by E. J. Wickson; Irrigation Conditions in Imperial Valley, California, by J. E. Roadhouse; Mechanical Tests of Pumps and Pumping Plants used for Irrigation, by J. N. Le Conte; Irrigation in Klamath County, Oregon, by F. L. Kent; Irrigation Investigations in Yakima Valley, Washington, 1904, by O. L. Waller; Irrigation Conditions in Raft River Water District, Idaho, 1904, by W. F. Bartlett; Irrigation Investigations at New Mexico Experiment Station, Mesilla Park, 1904, by J. J. Vernon; Irrigation Investigations in Western Texas, by Harvey Culbertson; Pumping Plants in Texas, by C. E. Tait; Irrigation in Southern Texas, by A. J. Bowie; Rice Irrigation in Louisiana and Texas in 1903 and 1904, by W. B. Gregory; Rice Irrigation on the Prairie Land of Arkansas, by C. E. Tait; Irrigation Experiments at Fort Hays, Kansas, 1903 and 1904, by J. G. Haney; Irrigation near Garden City, Kansas, 1904, by A. E. Wright and A. B. Collins; Pumping Plants in Colorado, Nebraska, and Kansas, by O. V. P. Stout; Irrigation near Rockyford, Colorado, 1904, by A. E. Wright; The Irrigation and Drainage of Cranberry Marshes in Wisconsin, by A. R. Whitson; and Report of Drainage Investigations, 1904, by C. G. Elliott.

A leading line of work has been the collection of information regarding the duty of water. This has included the measurement of the water at the heads of main canals where they leave the streams, at the heads of laterals from main canals, and at the margins of fields where the water is actually applied to the crops. The differences in the quantities found at these different points represent approximately the losses of water in transit. The average depth to which the water measured would cover the land irrigated was found to be as follows: Main canals 5.13 ft., laterals 4.03 ft., farms 3.07 ft.

In addition to these measurements of the quantities of water used in common practice, experiments were made to determine the results of applying the water at different stages of the crop's growth. These experiments look to a more scientific use of water in irrigation, and if possible a more economical use. The experiments indicate that the largest product from the use of given quantities of water and the largest product per acre do not coincide.

At the New Mexico Station it was found that the largest product per acre inch of water was secured when the depth of water applied was 24 in., but the largest product per acre was secured with a depth of 35 in. These experiments have not been extended far enough to give any definite conclusions as yet.

Experiments have also been made in increasing the duty of water by lessening the losses in apylying it to crops. Experiments in California in applying water by flooding in shallow furrows and in deep furrows showed comparative losses as follows, taking the loss in flooding as 100 per cent: Flooding, 100 per cent; furrows 3 in. deep, 87 per cent; furrows 12 in. deep, 75 per cent.

A large number of measurements of the losses from canals by seepage and evaporation are reported. A general average of all of these measurements gives 6.76 per cent of the water entering the headgates of canals lost per mile of length, the losses varying from almost nothing to almost 100 per cent. The measurements show, however, a large decrease in the percentage of loss with increase in the size of the canals. Averaging all of the measurements according to the sizes of canals gives the results shown in the following table:

Losses of water from canals by seepage and evaporation.

	Percentage loss per mile.
13 canals carrying 100 cu. ft. per second or more	0.95
15 canals carrying between 50 and 100 cu. ft. per second	2.58
15 canals carrying between 25 and 50 cu. ft. per second	4.21
24 canals carrying less than 25 cu. ft. per second	11.28

The water escaping from canals is not, however, all lost, as is shown by the measurements of return seepage reported. A large number of measurements of the gain in the flow of the South Platte and its tributaries is summarized. The measurements on the South Platte itself are divided into two groups, representing 7-year periods, showing a large increase in the rate of gain in the second period over that in the first.

A series of measurements made in 1903 show the gain of 727.61 cu. ft. per second in the flow of the river in 232.75 miles, or 3.3 cu. ft. per second per mile throughout the course of the stream. Measurements for the months of July and August, 1903, show gains between the mouth of the canyon of the South Platte and the Colorado-Nebraska line of 307 and 344 per cent, respectively. Similar measurements for a large number of other streams are given.

The cost of preparing land for irrigation, including removing sagebrush, smoothing or leveling land, and building laterals is given as ranging from $3.50 to $35 per acre, varying with the original condition of the land.

A large part of the report is devoted to pumping investigations throughout the arid and semiarid regions. The summary of results shows that the pumps tested gave an average efficiency of 41.17 per cent, while the fuel cost of raising water varied from 1.6 to 25.3 cts. per foot-acre-foot, the larger cost being for plants requiring less than 1 horsepower, and the smaller cost for large steam plants, using cheap crude oil for fuel. The descriptions of the plants in use are of great value for bringing out the good points as well as those which should be avoided.

The average annual cost of raising water with windmills, including interest on the investment, is given as $9.50 per acre. From this high cost the conclusion is drawn that windmill pumping, except for the irrigation of high-priced crops, will not be found profitable.

The drainage work reported on includes the reclamation of swamp and alkali lands in the arid region, the protection of bottom lands from overflow, the drainage of farm lands, and protection of hillsides from erosion by means of underground drains. The methods of laying out and constructing drains for all of these purposes are discussed and the results obtained are given.

Duty of water, B. P. Fleming (*Wyoming Sta. Bul. 67, pp. 20*).—This bulletin contains summaries of all of the measurements of duty of water made by the Wyoming Station from 1893 to 1903.

The average depth of water applied to different crops per year at the station during that period was as follows: Alfalfa 1.97 ft., barley 1.53 ft., oats 1.73 ft., and wheat 1.62 ft. Concerning the length of the irrigation season for these crops the conclusion is that a water supply should be available from June 1 to September 15.

In addition to measurements of the quantity of water used in general practice, experiments have been carried on to determine the relation between the quantity of water applied and the yield. These experiments have included potatoes and oats. Potatoes yielded the largest return per acre when receiving water to a depth of 16.29 in. and oats with 43.59 in. The largest returns per inch of water applied were with potatoes 16.29, and with oats 16.59.

These measurements show that with oats at least the largest return per unit quantity of water does not coincide with the largest return per acre. "Consequently when a man has a large area of land and a small water supply he will probably find that he will be making the best use of his available supply when he spreads that amount over a larger area than it is the common practice to do."

The Winterton Irrigation Settlement (*Notes on Agriculture in Natal, Maritzburg: Dept. Agr., 1905, pp. 9–20*).—In 1904 the agricultural development act was passed for the purpose of securing rural settlement in Natal. A board was created which is authorized to make loans to settlers, limited to £60 for the first year, for the purchase of live stock, implements, food, etc., to be repaid in 3 years and bearing 4½ per cent interest.

A dam has been built and a canal 18½ miles long which will irrigate 17,940 acres. This area is divided into three classes—first class land fit for special crops, second class land fit for mixed farming, and third class land fit only for grazing. This is to be leased to settlers in tracts varying from 250 to 500 acres according to its classification. Settlers are advised that they will need capital of at least £250. The article contains information as to the necessary expenditures and probable returns from farming operations.

Diagrams of mean velocity of uniform motion of water in open channels; based on the formula of Ganguillet and Kutter, I. P. CHURCH (*New York: John Wiley & Sons, 1902, pls. 11, desc. text*).—This set of diagrams was prepared for the purpose of determining the mean velocity in open channels instead of computing it in each case from Kutter's formula.

There is one diagram for each of eleven different values of "n," or the coefficient of roughness, ranging from 0.009 to 0.035, and ranging from 0.1 to 25 ft. in values of R, the hydraulic radius, and for slopes varying from 0.01 ft. per thousand to 100 ft. per thousand, that is, values of S varying from 0.00001 to 0.100. This is sufficient range to cover the ordinary cases.

The coefficients of roughness for channels of various kinds are given as follows:

0.009, for well-planed timber evenly laid.

.010, plaster in pure cement; glazed surfaces in good order.

.011, plaster in cement with one-third sand; iron and cement pipes in good order and well laid.

.012, unplaned timber, evenly laid and continuous.

.013, ashlar masonry and well-laid brickwork; also the above categories when not in good condition nor well laid.

.015, "canvas lining on frames;" brickwork of rough surface; foul iron pipes; badly jointed cement pipes.

.017, rubble in plaster or cement in good order; inferior brickwork; tuberculated iron pipes; very fine and rammed gravel.

.020, canals in very firm gravel; rubble in inferior condition; earth of even surface.

.025, canals and rivers in perfect order and regimen and perfectly free from stones and weeds.

.030, canals and rivers in earth in moderately good order and regimen, having stones and weeds occasionally.

.035, canals and rivers in bad order and regimen, overgrown with vegetation, and strewn with stones and detritus.

Proceedings of the second annual Iowa State Drainage Convention (*Proc. Iowa State Drainage Conv., 2 (1905), pp. 65, figs. 7*).—This report contains the minutes of the meetings and the following papers: Appraisement of Damages and Assessments of Benefits in Drainage Work, by C. G. Elliott; The New Iowa Drainage Law, by R. M. Wright; The Importance of Drainage in Good Roads Construction, by A. Marston; President's Address, by D. A. Kent; The Drainage of Meandered Lakes, by L. E. Ashbaugh; Progress in Drainage Improvements during 1904, by J. F. Ford; The Relation of the Soil to Underdrainage, by W. H. Stevenson.

Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, F. H. NEWELL (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 146, pp. 267*).—The papers included deal with water laws, hydrography, power engineering in irrigation, tunneling, field and office accounts, pumping, diamond drilling, stream gaging, computations, aquatic plants, camp sanitation, drainage, silting of reservoirs, flow under ice, and a few reports of particular projects.

A number of committee reports of general interest on concrete, cost-keeping, duty of water, and pumping are added, and others of a more special kind relating to standard specifications, forms of reports, etc., of interest to members of the Reclamation

Service. There is appended a partial directory of members, with records of their training and experience, and a list of technical papers by engineers in the Reclamation Service.

Development of underground waters in the Eastern Coastal Plain Region of southern California, W. C. MENDENHALL (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 137, pp. 140, pls. 7, figs. 6*).—A brief history of the irrigation companies diverting water from streams is first presented, with brief notes on drainage districts. The source of underground water supply is then discussed, data being given to show that the draft by pumping has materially decreased the former artesian area. Five maps are presented, showing present and past artesian areas, hydrographic contours, irrigated lands, canals, location of wells, and the usual topographic and other data. The larger part of the paper consists in a list of nearly 2,800 wells, giving owners, location, description, depth, and water elevation, solids in solution, temperature, method of lift, cost of well and machinery, use of water, and estimated discharge.

The same method of treatment is followed in the second and third of this series, dealing with the Central Coastal Plain Region of Southern California (Water-Supply and Irrig. Paper No. 138, pp. 162, pls. 5, figs. 5) and Western Coastal Plain Region of Southern California (Water-Supply and Irrig. Paper No. 139, pp. 105, pls. 8, fig. 1).

Observations on the ground waters of Rio Grande Valley, C. S. SLICHTER (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 141, pp. 83 + III, pls. 5, figs. 32*).—An investigation of the underflow of Rio Grande near El Paso, which was popularly supposed to be enormous, showed a probable flow of only 50 gals. per minute, the water being too salt for any use whatever.

Data regarding the supply below El Paso and in Mesilla Valley are presented, showing the small amount of water contributed by the river. A detailed study of 18 pumping plants is given, with cost data, which shows a variation in cost of water delivered of from $2.21 to $13.20 per acre-foot, the fuel cost varying even more—from $0.70 to $5.80 per acre-foot. In eight cases the wells are lowered over 20 ft. by pumping, usually indicating too large power for the capacity of the well. Larger strainers and deeper wells are recommended.

Analyses of water samples from El Paso are given in an appendix.

The hydrology of San Bernardino Valley, California, W. C. MENDENHALL (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 142, pp. 124, pls. 12, figs. 16*).—"This report is one of a series on the underground waters of southern California. In this valley, where irrigation practice has attained a high degree of perfection, the underground waters are of very great importance, two-thirds of the irrigated acreage being dependent upon them either wholly or in part. The author has had in mind the practical irrigator and questions which arise concerning title to percolating waters."

After a preliminary discussion of the valley, its settlement, irrigation development, rainfall, soil, and runoff, the author devotes about 40 pages to a treatment of San Bernardino artesian area, its geology, water supply, and particularly the decline of the waters in the past ten years. The conclusion is reached that "it is obviously unwise to increase present drafts upon the basin," and that better methods in irrigation practice and a "fully supported policy of forest conservation and restoration are essential."

Yucaipe and Riverside basins are also briefly discussed, and miscellaneous data on temperature, water analyses, and stream and canal gagings are given. A list of about 500 wells, with depth, cost, and other data is given.

Wells, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 9 (1905), No. 23, pp. 734–736, figs. 6*).—A cheap portable machine for driving wells by hand, with notes on its use.

Windmills, M. Ringelmann (*Jour. Agr. Prat., n. ser., 10 (1905), No. 42, pp. 496–500, figs. 4*).—A description of some American and European mills with a discussion of the pressure of wind and methods of regulating mills.

Experiments on steel-concrete pipes on a working scale, J. H. Quinton (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 143, pp. 61, pls. 4, figs. 4*).—Seven 20-ft. sections of pipe of 5 ft. inside diameter and 6 in. thick, reenforced with welded steel rings, were made, using various proportions of cement, sand, and gravel. These were coated inside with different plasters and paints and tested with all heads up to 140 ft. It was found impossible under moderate heads to prevent sweating through every coating tried and serious leakage through tamping seams under heads of over 60 ft.

To avoid the inequalities incident to continuous pipe, a section of four 5-ft. segments was made and tested with various coatings. Further tests were made on pipes of 8 in. inside diameter. The writer concludes that extreme care is essential in mixing and tamping; that paints are too thin and soap-and-alum mixtures not wholly satisfactory, and that heads of over 70 ft. are not practicable. No cost data are given.

Cement mortar and concrete: Preparation and use for farm purposes, P. L. Wormeley, Jr. (*U. S. Dept. Agr., Farmers' Bul. 235, pp. 32, figs. 14*).—This bulletin describes in a very elementary way the proper method of mixing and handling concrete.

The use of different materials for making concrete is explained, and detailed directions are given for making sidewalks, basement floors, steps, and fence posts. In an appendix are given results of some tests on concrete fence posts, tests showing the effect of retempering Portland-cement mortar, and a diagram showing the effect of clay on cement mortars.

Trap rocks of Palouse region as road material, C. N. Little and W. G. Turley (*Idaho Sta. Bul. 50, pp. 16, figs. 2*).—Abrasion and cementation tests of 13 samples with notes on methods employed and comparative tests of 3 samples made in the laboratories of this Department.

The good roads problem in Iowa, A. Marston, C. F. Curtiss, and T. H. MacDonald (*Iowa Engin. Sta. Bul., 2 (1905), No. 6, pp. 24, pls. 12, figs. 5*).—This bulletin contains a copy of the law creating the Iowa State Highway Commission, a general discussion of the State with regard to its road conditions and road materials, and brief notes as to methods of road construction and maintenance.

Third annual report of the State board of public roads, Rhode Island (*Ann. Rpt. Bd. Pub. Roads R. I., 3 (1905), pp. 39, pls. 47, fig. 1*).—A general discussion is given of the advantages of good roads and the necessity of prompt repairs on macadamized roads.

During 1904, 16.3 miles of stone roadways were contracted for at an average cost of $4,953.05 per mile. In all cases where roads have been improved grades have been reduced. The methods of testing stone as road material in this Department are described and a table showing the road-making value of Rhode Island material is given. A copy of the standard specifications for stone roadways is also given. The report contains a large number of companion pictures showing roadways before and after improvement.

Eighth annual report of the commissioner of highways, Ontario, 1903 (*Ann. Rpt. Comr. Highways Ontario, 8 (1903), pp. 102, pl. 1, figs. 25, dgms. 3*).—This report deals principally with defects of employing statute labor on highways in the Province of Ontario, and the advantages to be gained by commutation of this labor and expenditure of the funds thus acquired under the direction of expert roadmakers.

A tabular statement is given showing the counties in which commutation is provided for, and the rates allowed, which vary from 50 cts. to $1 per day. There is also given a tabular statement of the road expenditures by counties for the years

1889–1901. The report gives directions for all classes of road work, including grading, building culverts, and wooden, steel, and reenforced concrete bridges.

Hydraulic motors, I. P. CHURCH (*New York: John Wiley & Sons, 1905, pp. IX+269, figs. 125, dgms. 7*).—This book includes both the theory and descriptions of water wheels, impulse wheels, turbines, centrifugal pumps, pressure engines, accumulators, and hydraulic rams. It represents the most modern treatment of these important lines of machinery.

A brief discussion is also given of flow in pipes and open channels and backwater due to weirs. An appendix contains graphic conversion scales, diagrams showing friction head loss and discharge of cast-iron and wrought-iron pipe for various velocities, diagrams of Kutter's formula, four-place logarithms, and three-place trigonometric functions.

A steam traction engine, R. DESSAISAIX (*Jour. Agr. Prat., n. ser., 9 (1905), No. 24, pp. 774, 775, fig. 1*).—An improved English engine, with large heating area, and adapted to burning wood and refuse.

Methods of testing farm machines, A. NACHTWEH (*Fühling's Landw. Ztg., 54 (1905), Nos. 19, pp. 663–667, figs. 3; 22, pp. 769–775, figs. 5*).—A description of a recording dynamometer for farm vehicles, with notes on its use; a dynamometer with a hydraulic registering device, a recording torsion dynamometer by Morin, and a simplified form by Wüst.

New farm machinery, E. WROBEL (*Fühling's Landw. Ztg., 54 (1905), No. 18, pp. 625–628, figs. 4*).—A description of a new driving gear to reduce friction in fanning mills, improved interchangeable screens for threshing machines, and an improved universal seed drill.

New farm machinery, A. NACHTWEH (*Fühling's Landw. Ztg., 54 (1905), No. 19, pp. 667–671, figs. 4*).—A new universal farm mill adapted to both crushing and rough grinding. The rolls are smooth for half their length, being geared for both equal and unequal rates of speed.

New farm machinery, K. VORMFELDE (*Fühling's Landw. Ztg., 54 (1905), No. 20, pp. 695–701, figs. 4*).—A carbureter for making Benoid gas and a special gas engine for using this gas are described.

New farm machinery; the Heller plow for subsoiling, B. TÖLKSDORF (*Fühling's Landw. Ztg., 54 (1905), No. 16, pp. 555–557, fig. 1*).—Thorough subsoiling without heavy draft is claimed in this plow, which is constructed with a wedge-shaped subsoiler attached to an ordinary moldboard in such a way that the under layer of soil is moved laterally the width of one furrow without being turned over, the upper soil being turned over on top of the moved strip of subsoil.

RURAL ECONOMICS.

The state and agriculture in Hungary, I. DARÁNYI, trans. by A. GYÖRGY (*London: Macmillan & Co., Ltd., 1905, pp. XXII+264, map 1*).—This book is a discussion of the principles followed and the methods used by the Department of Agriculture of Hungary in the promotion of the agricultural interests of that country.

The questions of land tenure and fiscal policy are left on the side, and attention is centered upon the problems involved in improving the quality of cereals, hops, hemp and flax, wine, fruits, live stock, etc. "The intention in generally encouraging the agricultural industry was directed by the desire that our farmers, in the first place the small farmers, should be convinced of the advantages of 'qualitative production,' of using better seeds, producing more commercial plants, and, in general, of farming on a more scientific plan."

Cooperation among the farmers is encouraged by the government. "Acknowledging the great influence which farmers' clubs exercise on the development of

agriculture, the department uses every opportunity to stimulate their interest and activity. In preparing agricultural regulations and bills it consults these clubs, and also helps materially their shows, lectures, or any other of their public enterprises." And again, "the literature of cooperation has for a long time been subsidized by government."

"The Department of Agriculture has issued, for many years, reports on the condition of both home and foreign crops, for the use of the farmers, and these have continually increased in scope. . . . The number of correspondents was in 1895 only 875, but in 1902 already 1,143. There are, besides these, 87 correspondents dealing with insect pests." . . .

The measures taken to promote hemp growing illustrate the methods of promoting plant industries. "Hop growing, which is unable to supply more than half the home demand, is one of the industries in process of development. There is a regular and special instructor for hop growing, since special knowledge is required. To stimulate and equalize hop growing, the department distributes yearly tested hop seedlings among the producers."

The business side of farming, F. W. CARD (*Ann. Rpt. Bd. Agr. R. I., 19 (1903), pp. 66-81*).—This is mainly a discussion of the necessity of strict accounting on the part of the farmer, and of methods of keeping such accounts. It contains also a general discussion of the relation of fixed and movable capital on the farms.

At present in New England about one-half of the capital belonging to farmers is invested in land. It is pointed out that it is to the advantage of the farmer to decrease the proportion of his capital which is in land, in order to decrease fixed charges. These charges may also be decreased by arranging the farm work in such a way that both men and teams may be continuously employed.

The economics of good roads, W. E. MCCLINTOCK (*Ann. Rpt. Bd. Agr. R. I., 20 (1904), pp. 86-94*).—This paper reviews the conditions which have in earlier times and in other countries made the construction of good country roads necessary, and forms an estimate of the advantages to be derived at the present time by the construction of good roads.

The first argument is that products can be placed upon the market more cheaply. The second argument is that good roads would facilitate the consolidation of the country schools and thus improve the quality of rural education. It is argued also that good roads would tend to keep the young people in the country who at present have such a strong tendency to seek their fortunes in the cities.

The sugar production of the world, H. PAASCHE (*Die Zuckerproduktion der Welt. Leipsic: B. G. Teubner, 1905, pp. VI+338*).—This volume contains a statistical and descriptive discussion of the sugar production of the world.

The book is divided into three main divisions. The first part is devoted to the beet-sugar industry of the principal sugar-beet producing countries, the second part to the cane-sugar industry of the various countries where this industry is carried on, and the third to the competition of beet and cane sugar on the world market.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, 7 (1905), Nos. 7, pp. 55-62; 8, pp. 63-70; Sup., pp. 71-78*).—Number 7 contains descriptive and statistical materials concerning yield and quality of crops in the United States, cotton seed and cotton-seed products in the United Kingdom, the United States exports and imports of rice and the exports of grain, the hop movement in the United States, and prices of agricultural products.

In No. 8, crop areas in Argentina, live stock in Germany, the area and production of tobacco in various countries, and flax seed and its products in the United Kingdom are the principal subjects discussed. The supplement to No. 8 contains the annual report of the Bureau and tables showing the acreage, production, and value of the principal farm crops of the United States in 1905.

Statistical yearbook of Austria, 1904 (*Statis. Jahrb. K. K. Ackerb. Min., 1904, pp. 305, pls. 10, dgms. 5*).—This reports contains statistics on grain, potato, sugar-beet, and wine production. The colored maps show the localities in which each of these products is grown.

The annual statistical report of the Tokyo Chamber of Commerce, 1905 (*Ann. Statis. Rpt. Tokyo Chamber Com., 1905, pp. VI+171*).—This report contains statistics of the receipts and shipments of agricultural products in the city of Tokyo, and the range of the price of these commodities.

Annual report of the bureau of industries for the Province of Ontario, 1904 (*Ann. Rpt. Bur. Indus. Ontario, 1904, pp. 48*).—Part 1 of this report contains statistics of the grain crops, root crops, hay and clover, fruit and fruit trees, live stock and dairy interests, labor and wages, market prices, and the values of farm property. Part 2 shows the total number and amount of chattel mortgages on record in Ontario on December 31, 1904, against (1) all occupants; (2) farmers; together with totals for the province for the past ten years.

State of Washington, its resources, natural, industrial, and commercial, 1905 (*Bien. Rpt. Bur. Statis. Wash., 1905, pp. 208+48, pls. 97, dgm. 1*).—This report describes the agricultural resources of the State of Washington. Statistics are given of the live-stock industry, of cereal, hop, and fruit production, and of the lumber industry of the State.

AGRICULTURAL EDUCATION.

Agricultural education in Belgium (*Notice sur l'economie rurale et l'enseignement agricole de la Belgique. Brussels: Min. Agr., 1905, pp. 93–190, figs. 25*).—This is a description of the system of agricultural education in Belgium, prepared for distribution at the Universal Exposition in Liège in 1905.

This description includes the following classes of institutions: (1) Colleges—the State School of Veterinary Medicine at Brussels, the Agricultural Institute at Gembloux, and the Agronomic Institute of the University of Louvain.

(2) Secondary schools, of which there are 3 separate agricultural schools located at Carlsbourg, La Louvière, and Huy, and 16 agricultural schools conducted as departments of other educational institutions; courses of agronomy in royal atheneums; State schools of horticulture at Ghent and Vilvorde and private subsidized schools of horticulture at Mons, Tournai, Liège, and Carlsbourg, and a school of practical horseshoeing at Molenbeek-Saint-Jean.

(3) Agricultural schools for women, including one higher agricultural school in connection with the Institute of the Sacred Heart and Immaculate Conception at Héverlé, and 10 secondary schools located, respectively, at Bastogne, Bouchout, Brugelette, Herve, Gooreind, Gyseghem, Oosterloo, Overyssche, 'S Gravenwezel, and Virton, besides 3 schools having departments for women located, respectively, at Cortemarck, Heule, and Waremme. There are also traveling dairy schools for women and in connection with the schools at Héverlé and Overyssche, schools of cheese making.

(4) Popular instruction, including primary agricultural and horticultural trade schools (10 of which are agricultural and 9 horticultural departments of other schools), and popular instruction for adults (itinerant instruction consisting of from 15 to 30 lectures on agriculture, horseshoeing, apiculture, and other special subjects).

In addition the statistics of agricultural education are presented; the service of agronomes (graduates of agricultural colleges engaged in extension work for the State), and accounts of institutions connected with agricultural educational institutions, such as botanic gardens, chemical and bacteriological institutes, analytical laboratories, experiment stations, and reading circles.

The place of the agricultural and mechanical college in the educational scheme of the South, B. Ayres (*South. Ed. Rev., 2 (1906), No. 8, pp. 485–493*).—The development and present status of agricultural and mechanical colleges are discussed, and a plea is made for a closer union between southern institutions of this class and other colleges and preparatory schools of the South.

It is pointed out that the college entrance requirements recommended by the Association of Colleges and Preparatory Schools of the Southern States do not take the agricultural and mechanical colleges into consideration. The writer calls attention to the rapid growth in enrollment and beneficent influence of the great universities of the West, and endeavors to show how closer cooperation between all the educational institutions of the South would lead to similar progress.

Nature study and agriculture (*Course of study and syllabus for elementary schools. Albany: N. Y. State Ed. Dept., 1905, pp. 154–172*).—This syllabus presents material and suggestions for nature study extending over the first 6 years of the elementary school curriculum, and agriculture extending over the remaining 2 years.

Both nature study and agriculture are outlined by years, the former including studies of animals, plants, and natural phenomena (weather, water, winds, clouds, etc.). The first year of elementary agriculture is devoted to studies of domestic animals and plants of the farm, and the second year takes up the study of the State of New York considered as a great farm, with special studies on dairying; pastures, meadows, and forage; alfalfa as fodder; fruit growing, and insect pests and methods of destroying them. A list of reference books for the use of teachers is appended.

"The aim in the first five years is to put the child into sympathetic touch with his environment, and to give him certain units of basal knowledge with which he may interpret the facts of geography and agriculture, which later are to be based upon this nature study. . . . In the fourth and fifth years nature study, observational geography, and agriculture, beginning in the locality and widening out into the State, are closely related, and they supplement each other." In the sixth year there is a review, and some generalizations are made in preparation for the study of agriculture, which begins in the seventh year.

There is a logical sequence in the work as outlined. This is not strikingly apparent in the work of the earlier years, but gradually the pupil is led to make a special study of the life of certain plants and animals, the distribution of these plants and animals, and the relation of plants to soil, plants to animals, and of both plants and animals to man. The pupils are led to see that they are studying agriculture "for the purpose of finding out how to enhance the animal and plant values to man," and that "these values depend not only upon improved soil conditions and economic treatment of farm products, but also upon intelligent marketing and upon the principles of economic exchange of home products for those raised in other sections of the State and country."

Syllabus for secondary schools. Physical geography and agriculture (*N. Y. State Ed. Dept., Secondary Ed. Bul. 27, pp. 132–157*).—The syllabus for physical geography includes outlines for a study of the earth as a planet, the air, the ocean, water other than the ocean, and the land. It is recommended that as much time be devoted to the study of the land as is devoted to the four other subjects outlined.

The syllabus on agriculture was prepared at the request of the Education Department by representatives of the faculty of the College of Agriculture, Cornell University. The outline presents an orderly arrangement of work for three periods a week extending over one year, and it is recommended that this work be taken in the second year of the high school after the pupil has completed one year's work in biology and has acquired some knowledge of elementary chemistry. It is also recommended that abundant laboratory work should be provided, at least one period out of every three being devoted to such work.

The order of treatment and the reason for adopting this order are thus stated in the syllabus: "Agricultural operations are conducted for two immediate purposes—to raise plants and to raise animals. Plants are raised either for their own value or for their use in the feeding of animals. In studying agriculture, therefore, it is well to begin with the plant, then proceed to the animal, and then consider questions of practice and management that grow out of these subjects."

The studies on the plant and crops include the plant itself, environment of the plant, and actual study of the leading crops of the community. Under animals and animal husbandry are included studies of domestic animals and their relationships, the nutrition of animals, and animal products. Part 3 of the syllabus is devoted to farm schemes and management, including kinds of farming, rotations, lay-out of farms, tillage, drainage, and irrigation.

Agriculture in the public schools, F. MUTCHLER (*Ann. Rpt. Conn. Bd. Agr., 38 (1904), pp. 215–227*).—An address given at the annual midwinter meeting of the Connecticut Board of Agriculture, Hartford, December 14–16, 1904, for the purpose of showing how elementary agriculture should be taught.

School gardens, B. T. GALLOWAY (*U. S. Dept. Agr., Office Expt. Stas. Bul. 160, pp. 47, pls. 5*).—A report is given on the school garden work in the District of Columbia, conducted in a cooperative way by this Department and the normal schools of the District, under the direction of the Bureau of Plant Industry and Miss Susan B. Sipe, instructor in botany in Normal School No. 1.

The garden work described includes the boys' vegetable gardens on the grounds of this Department, the home gardens of the normal school pupils, and the improvement of school grounds at Normal School No. 1 and 32 other schools in the District. Supplementary to this report is a report by Miss Sipe on school gardens visited by her in the summer of 1904 in Hartford, Conn.; Boston, Brookline, Hyannis, and Worcester, Mass.; St. Louis, Mo.; New York City, Yonkers, and Rochester, N. Y.; Cleveland, Ohio, and Philadelphia, Pa. Throughout the bulletin an effort has been made to bring out the educational trend of garden work in the different enterprises described.

Municipal school gardens conducted by the Board of Public Education, Philadelphia, HELEN C. BENNETT (*Philadelphia: Bd. Pub. Ed., 1905, pp. 31, figs. 19*).—This is a report by the Supervisor of School Gardens in Philadelphia on the school garden work conducted in 1905 under the auspices of the Board of Public Education. The report includes outlines of lessons given to those working in the gardens, a description of nature-study material sent to schools, and brief accounts of school gardens in Boston, Hartford, New York, and Yonkers.

The ideal forestry college (*Indian Forester, 31 (1905), No. 2, pp. 61–73, pls. 3*).—The author visited the forestry colleges and institutes existing in Europe and gives his impressions as to what an ideal forestry college or school should be. The subject is considered under the various headings of situation, buildings, staff, studies, arrangement of the main educational buildings, college gardens, and college educational forests.

Forest school, H. S. GRAVES (*Bul. Yale Univ., 1. ser , 1905, No. 4, pp. 182–186*).—An account of the work of the Yale School of Forestry during the year.

A summer term in forestry has been added to the junior year. This course begins in July of each year instead of the following September. During the preceding summer it was devoted entirely to the subject of sylviculture and forest mensuration at Milford, Pa. By this plan much more time is available for field work than heretofore. During the year 84 students received instruction in forestry.

Soil and drainage, A. B. GRAHAM (*Agr. Col. Ext. Bul. [Ohio State Univ.], 1 (1905), No. 2, pp. 6–9, figs. 3*).—Ten simple experiments for use in public schools are described.

The educational beehive, E. F. BIGELOW (*Nature-Study Rev., 1 (1905), No. 5, pp. 202-209, figs. 4*).—A description is given of an observation hive invented by the author for use in nature-study work in schools.

Suggestions for grain-growing contests, score cards, and rules for judging wheat, oats, and corn, C. P. BULL (*Univ. Minn., Dept. Agr., Rural School Agr. Bul. 2, pp. 63, figs. 19*).—This bulletin is prepared for the purpose of encouraging grain-judging contests among the pupils in the common schools in each county of the State.

A general study of seeds and seed testing, including weights per bushel of some common seeds, market grades of wheat and oats, germination, and rules for judging seed, is followed by more particular and detailed studies of wheat, oats, and corn, in which the history, types, culture, harvesting, marketing, and judging of each class of grain are treated. Specimen score cards are given and rules for the use of the score cards. Following these studies there is a chapter on crop rotation and field management and a chapter giving suggestions for practical exercises in connection with the other work.

Legislation relating to farmers' institutes in the United States, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 135, rev. ed., pp. 35*).—In the revision of Bulletin 135 of the Office (E. S. R., 15, p. 523) the institute legislation of the Province of Ontario, Canada, is omitted. New enactments and amendments to farmers' institute laws, as well as changes in appropriations made since 1903, are included. New legislation has been enacted in Georgia, Oregon, South Dakota, and Wyoming, and amendments made in New York and Virginia.

Organization lists of the agricultural colleges and experiment stations in the United States (*U. S. Dept. Agr., Office Expt. Stas. Bul. 161, pp. 95*).

MISCELLANEOUS.

Eighteenth Annual Report of Illinois Station, 1905 (*Illinois Sta. Rpt. 1905, pp. 13*).—This contains a statement of the principal lines of work, a list of station bulletins, and a detailed financial statement for the fiscal year ended June 30, 1905.

Twenty-fourth Annual Report of Ohio Station, 1905 (*Ohio Sta. Bul. 163, pp. XXV*).—This includes an announcement concerning the work of the station, the organization list, a report of the board of control, a financial statement for the fiscal year ended June 30, 1905, and a report of the director summarizing the work of the station during the year.

Twenty-first Annual Report of the Bureau of Animal Industry, 1904 (*U. S. Dept. Agr., Bur. Anim. Indus. Rpt. 1904, pp. 632*).—This includes a report of the chief of the Bureau on the work done during the year, brief biographical sketches of the late E. A. de Schweinitz and H. E. Alvord, numerous articles previously noted or abstracted elsewhere in this issue, miscellaneous information, and the rules and regulations of the Bureau issued in 1904.

The articles previously abstracted from other sources are as follows: Foot-rot of sheep (E. S. R., 16, p. 713); the etiology of hog cholera (E. S. R., 17, p. 87); experiments concerning tuberculosis (E. S. R., 15, p. 916; 16, p. 1022); information concerning the milch goats (E. S. R., 17, p. 77).

The miscellaneous information, based mainly upon consular reports, consists of brief articles on the following subjects: The horse of Abyssinia; government aid to horse breeding in Italy; German imports of horses; the cattle industry of Brazil; the live-stock industry in Japan; live stock in Mexico; Venezuelan cattle for Cuba; number of cattle in Australasia; number of sheep and cattle in Buenos Ayres; importation of cattle into the Transvaal; American cattle and mules in northern Brazil; Russian association for breeding hogs and cattle; the frozen-meat trade with Great Britain; American meat a necessity in Germany; Germany's attempt to produce

canned meat; American meats in France; Spain's imports and exports of animal products; Prussia to make sausage; Argentine meat in Belgium; exports of Argentine animals and animal products; exports of animals and animal products from Denmark, 1903; imports and exports of animals and animal products of Uruguay; trade in animal products with Trinidad; frozen-meat trade of Argentina; German imports of animal products from Argentina; exports of frozen meats from New Zealand; New Zealand's exports of animal products; oleo oil in Turkey; number of sheep slaughtered in refrigerating plants in Argentina, 1897–1903; number of sheep in Australasia, 1885–1902; the sheep of Abyssinia; imports of wool at Boston, New York, and Philadelphia; the Australasian wool clip; wool exports from Australasia; production of wool in Argentina and Uruguay, 1893–1903; production and consumption of meat and dairy products in United Kingdom; decline of British butter making; cool-cured cheese in Canada; consumption of butter in Germany; glazed butter in Germany; dairy methods in Mexico; production and exportation of butter in Argentina; some dairy statistics of Queensland; milk-powder factory in France; galalith from skim milk; butter, cheese, poultry, and eggs in Kansas; consumption of poultry and eggs in Great Britain; testing for age of eggs; the Sicilian, or Buttercup, breed of chickens; Utility Poultry Club's laying competition; Australian egg-laying competition; goat raising in Mexico; the goats of Abyssinia; reindeer hair and its uses; frozen-rabbit industry of Australia; rabbits *v.* sheep in Australia; transportation in Persia; horses, cattle, and meat in France; poultry and eggs in the United Kingdom; and municipal slaughterhouse of Berlin.

Experiment Station Work, XXXI (*U. S. Dept. Agr., Farmers' Bul. 233, pp. 32, figs. 5*).—This number contains articles on the following subjects: Root systems of plants; fertilizers for asparagus; mushroom culture; onions in the Southwest; ether forcing of rhubarb; noodles; condimental feeds; beef *v.* dairy type for beef production; feeding skim-milk calves; animal food for ducks; milk from diseased cows; and cider vinegar.

Experiment Station Work, XXXII (*U. S. Dept. Agr., Farmers' Bul. 237, pp. 32, figs. 6*).—This number contains articles on the following subjects: Lime and clover; plant-food requirements of fruit trees; apple growing in New York; running out of seed wheat; high-protein seed wheat; tobacco seed selection; cover crop for tobacco fields; cereal breakfast foods; damaged wheat as feed; bedding for cows; amateur poultry raising; care of cream on the farm; paying the patrons of creameries; gassy fermentation of Swiss cheese; and yeast as a disinfectant.

Press bulletins (*Ohio Sta. Bul. 163, pp. 273–281*).—Reprints of press bulletins on the following subjects: Preliminary report of twelve years' experiments with wheat; lime as a fertilizer; Hessian fly and wheat midge; suggestions concerning the use of fertilizers; and a warning against fraud in the sale of nursery stock.

Index of Massachusetts State Station publications, vols. 1-12, 1883-1894 (*Massachusetts Sta. Index Number, 1905, pp. 44*).

Agriculture in Denmark (*Verslag. en Meded. Afdeel. Landb. Dept. Landb., Nijv. en Handel, 1905, No. 5, pp. 86*).—This is a general treatise on agricultural conditions in Denmark, including discussions on farm values and management, stock raising, exports, particularly of eggs, agricultural societies, and live-stock expositions.

NOTES.

Connecticut College.—Edwin Gilbert, of Georgetown, Conn., who died at Crescent City, Fla., February 28, bequeathed to the college a farm of about 356 acres, together with all tools, machinery, agricultural implements, live stock, and buildings, upon condition "that the same be taken and maintained in connection with said college as a farm and for the purpose of teaching or instruction in farming practically." In addition $60,000 was left to the college, the interest of which is to be used for caring for the farm and for instruction in agriculture, especially animal husbandry. The farm is said to be worth from $35,000 to $40,000.

The new brick and stone dormitory, for which the last legislature appropriated $60,000, is rapidly nearing completion, and the building will be ready for occupancy in time for the summer school. This dormitory contains 66 single bedrooms and 30 studies, which, except in the case of a few single rooms, are grouped in suites of 3, 2 bedrooms being connected with each study.

Delaware College.—J. A. Foord has resigned his position as professor of agriculture, to take effect early in April, and will become assistant professor of agronomy at the Ohio State University, instead of "assistant in agronomy," as previously announced.

Hawaii Station.—Jared G. Smith, director of the station, has returned to Washington for a few weeks. The sum of $1,750 has been raised by private subscription and placed at the disposal of the station for carrying on experiments in rice culture, with a view to decreasing the cost of production by modern methods and developing varieties better suited to local conditions or the substitution of other commercial crops on rice lands. The average annual rentals for rice land in Hawaii are about $35 per acre, which fact limits the prospects of crop substitution. Six thousand dollars has also been promised by private contributors to carry on a field experiment with tobacco, to test this crop on a commercial scale. The experiment will be made at Hamakua, where experiments in tobacco growing have been made by the station in previous years. An experiment in raising grapes for wine making has also been started on the island of Maui in cooperation with local farmers. A vineyard of 124 varieties of wine grapes has been set out.

Kansas College.—W. E. Mathewson, assistant professor of chemistry in the college, has been appointed assistant chemist of the station.

Kentucky Station.—W. E. Scherffius, chemist of the station, has been appointed agriculturist to fill the vacancy caused by the removal of J. N. Harper to the South Carolina Station.

Louisiana Stations.—The office of the Crop Pest Commission has been removed from Shreveport to Baton Rouge, and will now have its office in the experiment station building on the university campus at Baton Rouge. Arrangements have been made for cooperative experiments with this Department in studies on rice, including varieties, fertilizer tests, etc.

Maryland Station.—Walter R. Ballard, B. S., Kansas Agricultural College, has been appointed assistant horticulturist to succeed S. B. Shaw, resigned. O. C. Gibbs has been appointed clerk, vice H. H. Howell, resigned.

Minnesota University and Station.—According to the *Farm Students' Review*, the farmers' short course this year numbered 86, the largest attendance of any year thus far. The station is now ready to distribute a new variety of wheat, to be known as Minnesota No. 188. This variety has been in the test plats at the university farm for 10 years and has proved to have superior yielding qualities. It will be sold in small quantities, as is the usual custom.

Nebraska Station.—Press reports state that several new buildings have been erected at the substation at North Platte. These improvements include a $3,200 dwelling for the superintendent of the station and a $2,500 barn. Cattle barns, a small hog house, and a granary are now under construction.

New Hampshire College.—Arrangements have been concluded for a new library to cost $30,000, of which $20,000 was given by Andrew Carnegie and the remaining $10,000 by the Hamilton Smith estate of Durham. The Durham Library Association will turn over to the college library its collection of books, valued at $10,000, and also the income from its invested funds of $11,000 for the purchase of books. In exchange for this the college will extend the privileges of the consolidated library to all citizens of the town. The town of Durham will make a small appropriation annually toward the upkeep of the library.

Mrs. Hamilton Smith, of Durham, has recently given the sum of $10,000 for a new women's hall, which is much needed. The new $25,000 drill hall and gymnasium was dedicated the latter part of January. The building contains a main hall, 58 by 98 ft., with lockers and shower baths in the basement. The main floor is unobstructed, the roof being supported by steel trusses, which also support the balcony and running track. The building also contains a college club room, 20 by 40 ft., and offices and a class room for the military department and the physical director.

Rutgers College.—Dr. W. H. D. Demarest has been elected president of the college to succeed Dr. Austin Scott, who, as previously noted, has retired on account of ill health. Dr. Demarest has been acting president for several months past.

Cornell University.—According to *The Cornell Countryman* there were 237 students in the winter course which, with the 223 in the regular and special courses, and 30 graduate students in agriculture, gives a total of 490, the greatest total enrollment the college of agriculture has ever had. The registration in the winter course in poultry increased from 17 last year to 35 this year.

Ohio State University.—W. H. Freund has been added to the teaching staff of the dairy department in the university, as noted in *The Agricultural Student*. He has studied at Wisconsin, Guelph, and Kingston (Ontario), and will teach cheese and butter making in his new position.

Pennsylvania Station.—With a view to helping the farmers of the State to secure some information upon the important matter of the fertilizer requirements of their soils, a simple form of field test with fertilizers has been devised, involving the use of only 5 plats and less than $2 worth of fertilizer. Over one hundred such experiments have already been arranged for in cooperation with the station in different parts of the State, the station furnishing the fertilizer weighed out and ready for application. The station is also in correspondence with a considerable additional number of farmers, who desire to undertake the work entirely at their own expense. The station, in all cases, will furnish full directions for the experiment and suitable blanks for recording the results. It is hoped that many farmers will avail themselves of this opportunity, and that by means of these experiments it may be possible to secure indications as to the fertilizer requirements of different types of soil in Pennsylvania.

Rhode Island Station.—The term of Melville Bull, of Newport, who has been a member of the board since the station was established, expired January 31, 1906, and Robert S. Burlingame, of Newport, was appointed his successor. The new organization of the board is as follows: Charles Dean Kimball, president; Robert S.

Burlingame, vice-president; C. H. Coggeshall, clerk and treasurer; Thomas G. Mathewson and Jesse V. B. Watson.

The station is planning this season, in cooperation with the Bureau of Soils of this Department, to continue the investigations concerning the influence of sodium salts upon plant growth, and in addition to conduct a considerable number of cooperative field experiments in different parts of the State for the purpose of making a special study of the ability of certain plants to reveal specific soil requirements.

Vermont University and Station.—Arrangements have been made for the purchase of a valuable tract of ground adjoining the college campus, upon which Morrill Hall, the new agricultural building, will be located.

Virginia College and Station.—The State legislature has appropriated $86,000 for the college of agriculture and the experiment station for the biennial period. Of this amount $60,000 is to complete and equip the agricultural building, $5,000 a year for the experiment station, $6,000 a year for the crop pest commission, and $2,000 a year for furthering the cattle tick work.

M. P. Jarnagin, a former student of the University of Tennessee and a graduate of the Iowa Agricultural College, has been appointed assistant in animal husbandry in the college and station.

Wisconsin University and Station.—The registration in the college of agriculture this year numbers 1,052, and includes representatives from 12 States and 6 foreign countries. Of these 6 are graduate students, 136 in the long course, 322 in the 14 weeks' short course, 178 in the dairy course, and 410 in the farmers' course. Plans are well under way for the erection during the present summer of a building for agricultural engineering and an agronomy building.

The station has established 3 substations or farms in the northern part of the State, immediately south of Lake Superior. Over much of this district the forests have yielded up their pine lumber, and agriculture is almost undeveloped. In this region is a belt of heavy clay soil of very fair fertility, varying in width from a few miles to 15 or more, and comprising about a million acres. Immediately south of it is a sand region of very low to fair fertility. About 20 acres of land have been rented from the county poor farm several miles south of Superior City, in the red-clay region. This has been tile drained and will be planted with various crops the coming season. Near Ashland 30 acres of stiff red clay have been leased for a similar demonstration farm, and the third will be located in the vicinity of Iron River on sandy soil. It is expected that the expense of these farms will amount to about $6,500 annually, which will be paid wholly from State funds. It is planned to appoint a superintendent to have charge of the work, who will reside at Iron River and look after the other two farms. The work at the latter will be carried on by persons living on the farms or near by.

Wyoming University.—The Wyoming supreme court has handed down a decision in the Lander Agricultural College case, unfavorable to the latter. Under an enabling act passed in 1892 the people of the State voted to locate the agricultural college at Lander in Fremont County, but the legislature failed to establish the institution and designated the University of Wyoming as the proper institution to receive the Morrill and Hatch funds. A year ago the State legislature repealed the action locating the college at Lander, although the board of agriculture had received and partially used an estate of some $40,000, left by Philip Weiser, in starting an agricultural college at Lander. The Lander people raised money by private subscription to try the case in the courts, and served an injunction on the State treasurer to prevent his turning over the Morrill fund to the board of trustees of the university. The supreme court decided that the legislature had a constitutional right to repeal its former action and that the State agricultural college could not be moved from Laramie to Lander without legislative action, which leaves the university in possession of the Federal funds for its agricultural college and experiment station. The Lander people have now taken an appeal to the United States Supreme Court.

Measures before Congress.—A delegation of New England experts in the extermination of the gypsy and brown-tail moths were given a hearing before the House Committee on Agriculture February 13, upon the measure providing for control of these insects. As a result of the hearing, it was decided to draft a new bill, confining the work to the gypsy moth and providing for the establishment of a quarantine against its spread. This bill, since introduced, carries an appropriation of $250,000 as before, and places the work in the hands of the Secretary of Agriculture, in cooperation with the authorities of the States concerned and the State experiment stations.

A conference of representatives of the Southern States was also held in Washington to consider a bill appropriating $500,000 to aid in the extermination of the Texas fever cattle tick.

The Adams bill, increasing the endowment for the agricultural experiment stations, passed the House February 15, and the Senate March 12. There were no amendments in either case, and practically no objection. In its report upon the bill the House committee expressed its appreciation of the stations in the following terse language:

"The State experiment stations have done a remarkable work in developing the agricultural interests of the United States. No other single agency has contributed so much to the agricultural education of this country, or has eliminated more errors from farm practices, or has added more to the profits and comfort of farm life."

Other bills of interest to agriculture have been introduced as follows: Authorizing the Secretary of Agriculture to investigate systems of farm management and types of farming prevailing in different sections of the United States, the means used for maintaining soil fertility, methods employed in the production, utilization, and marketing of crops, and demonstration of improved methods of farming, $120,000; providing an appropriation of $100,000 for experimentation looking to the development of crops that can be best raised on semiarid lands by dry farming; authorizing the Secretary of Agriculture to make investigations to determine the best methods of utilizing small water supplies in irrigation, $50,000; to establish a Weather Bureau observatory at Sheridan, Wyo., $5,000; appropriating $5,000 to be expended by the Minnesota Station for investigating infectious diseases of domestic animals in Minnesota, their prevention, treatment, etc.; a concurrent resolution calling for the printing of 15,000 sets of the Farmers' Bulletins of this Department, from No. 1 to the last number issued, nearly two-thirds of which are for distribution to school libraries; to extend the provisions of the National Irrigation Act to the State of Texas; to apply a portion of the proceeds from the sale of public lands to the State normal schools for instruction in agriculture, the initial appropriation being $500,000, with an increase of $100,000 annually for 5 years, making the final annual appropriation $1,000,000; providing for the purchase of a site and the erection of a suitable building in the District of Columbia for the use of the Forest Service as a laboratory for experiments in the seasoning and preservative treatment of construction and other timbers, for testing the strength of timbers, and for determining means of preventing waste in lumbering and in the manufacture of wood products, $100,000; granting to the State of North Dakota 30,000 acres of land to aid in the maintenance of a school of forestry, the school having been established by the State legislature and located at Bottineau; appropriating the receipts from the sale of public lands in the State of Minnesota to the construction of drainage works for the reclamation of swamp and overflowed lands; authorizing the Secretary of Agriculture to make surveys and investigations to determine the benefits to be derived from the drainage of the public swamp lands of the several States and Territories, to prepare estimates of the cost of the same, and appropriating $10,000 for the work the first fiscal year, provision thereafter to be made in the annual appropriation acts for the Department of Agriculture; to enable the Department of Agriculture to conduct demonstration experiments in the eradication of pear blight in Idaho, in cooperation

with the Idaho Station, $10,000; and authorizing the registration in the United States Patent Office of the names of new varieties of horticultural plants, by the person who discovers, originates, or introduces the variety, under the law authorizing the registration of trade-marks.

Agricultural Education at the Meeting of the Department of Superintendence.—The Department of Superintendence of the National Educational Association held its annual meeting in Louisville, Ky., February 27 to March 1, there being about a thousand in attendance. This Department was represented by Mr. John Hamilton of this Office.

The subjects on the programme were chiefly such as related to city and town conditions. The afternoon of the last day, however, was devoted to the consideration of industrial training in the public schools. O. J. Kern, superintendent of schools of Winnebago County, Ill., presented a paper upon The Form of Industrial Training Most Practical and Best Suited to the Country Child. He made the point that education is primarily for self-support, and quoted President Roosevelt's declaration that every man in a country like ours should be "able to carry his own weight." He maintained that education should be of direct service as a wage-earner; that to effect this an effort should be made to interest country children in the things that they will be expected to understand when they come to engage in rural occupations. For this purpose the school garden, the experiment plat, and field excursions are valuable aids.

Charles H. Keyes, superintendent of schools of South District, Hartford, Conn., followed with a paper upon The Form of Industrial Training Most Practical and Best Suited to the City Child. In this he called attention to the danger there is in having the city child misunderstand the country, and declared it as his conviction that the city boy should know how it feels to actually do the things that the farmers' occupation requires. That this may be possible, school gardens for city children are a necessity.

A round-table discussion on agricultural education was held in the afternoon and evening of Monday, February 26, led by Supt. E. E. Balcomb, of the State Normal School, Weatherford, Okla. The discussion took the general direction of methods for introducing agricultural studies into the rural schools. There was general agreement as to the necessity for introducing agricultural study in some form into the public schools, and that this may be efficiently done opportunity must be afforded teachers to receive instruction in agriculture in the normal schools.

The Committee of the Round-Table appointed to draft resolutions summed up the points agreed upon in the following declarations, which were afterwards adopted by the Department of Superintendence:

"*Resolved*, That the Department of Superintendence of the National Educational Association is in hearty accord with that part of the report of the Honorable James Wilson, Secretary of Agriculture of the United States, in which he encourages the teaching of elementary agriculture in the public schools, and respectfully requests Congress to grant the appropriation of $13,620 which he has asked for to enable him to investigate and report upon the progress and present condition of agricultural instruction and institutions in this and foreign countries.

"*Resolved*, Second. That since it is essential to the successful teaching of industrial subjects in the public schools that the teachers shall first be trained for this work, we urge the State normal schools to give special attention to instruction in elementary agriculture, manual training, and domestic science.

"*Resolved*, Third. That in order to meet the extraordinary expenses of properly equipping these schools for giving this instruction we urge the adoption of the Burkett-Pollard Bill now before Congress making appropriation to the States for this purpose."

Traveling Summer School of Agriculture.—*The Cornell Countryman* announces that arrangements are being made for a traveling school during the summer, to be in

charge of one of the professors of the college. The plan has grown out of the desire of many of the men to travel in this country for the purpose of studying agricultural conditions, special agricultural industries, and the management of large farm enterprises. A petition signed by 17 students led to deciding upon the plan for such a traveling school to be undertaken the coming summer, and this plan has been ratified by the board of trustees.

"Certain academic requirements are made obligatory, as well as the consent of the faculty concerning each individual participant. The trip will last at least six weeks, and a deposit of $400 must be placed with the university treasurer, unexpended moneys to be returned. Six hours of university credit are given. It is hoped that Prof. Thomas F. Hunt will take charge of the first trip—summer of 1906."

The party hopes to have its own cars, a sleeper and a dining car, the latter being equipped with books and writing materials and serving as a study room in the evening. The proposed route lies through Washington, the cotton, tobacco, and trucking States of the South, the sugar and rice industries of Louisiana, the cattle ranches of Texas, and to the far West where irrigation methods, etc., will be studied. This is a new departure in agricultural education and will be followed with much interest.

Colorado School of Forestry.—We learn through *Science* that Gen. W. J. Palmer and Dr. W. A. Bell, of Colorado Springs, have given to Colorado College a tract of 15,000 acres of forest land to serve for field work in the practical study of sylviculture and forest botany. The lecture course in the forestry department will be given at Colorado College. The tract is situated at the foot of Pikes Peak, and affords a splendid opportunity for the study of irrigation, as well as forestry problems. It is stated that when Colorado was first settled it contained 36,000 square miles of forest area, and since that time 30,000 square miles of virgin forests have been destroyed. The forest school will be opened next September.

A People's High School in Austria.—A people's high school, similar to the people's high schools in Denmark (E. S. R., 17, p. 519), is maintained at Otterbach, near Schärding, by George Wieninger, president of the local agricultural society, who meets all expenses of the institution except the salaries of nonresident lecturers, which are paid by the State. The equipment of the school includes a model farm, museum of agricultural, natural science, and ethnographic specimens, a large auditorium, and a library. Free lectures and demonstrations have been given since 1845, and since 1890 32 of these have been given each year. These lectures and demonstrations are given on Sunday and are attended annually by from 3,000 to 4,000 farmers and farmers' sons who can not attend school. The object of the lectures is to assist in the general instruction of the rural population and to diffuse special knowledge concerning modern agricultural methods. Those who attend 100 lectures receive a diploma; those who attend 200, a silver medal, and those who attend 300, a gold medal. Lectures are given on potatoes, fertilizers, forestry, science, and agriculture, diseases of digestive organs, the herd book in animal husbandry, sugar as food, etc. In addition to these Sunday lectures short courses of from 1 to 2 weeks are offered in feeding, distilling, bookkeeping, poultry culture, dairying, and in normal work for teachers.

Agricultural Education at Antigua.—As described in a recent number of the *Agricultural News*, instruction in agriculture in Antigua includes lessons at the grammar school in agricultural science and practical work in the school garden. It is claimed that pupils pursuing such a course are able upon leaving school to deal much more intelligently and successfully with agricultural problems than those who have no such training. Attention is also given at the grammar school to the training of teachers for giving some instruction in agricultural subjects in the elementary schools. With this object in view courses of lectures on the elements of plant physiology and on tropical hygiene have been given to the teachers of the elementary schools of the island and to the students of a female training college in Antigua.

The importance of school garden work is also emphasized. At the present time 72 boys are taking the work in agricultural science and 40 teachers are pursuing the training courses.

Training Oklahoma Teachers for Elementary Agriculture.—The Southwestern State Normal School of Oklahoma, at Weatherford, has recently established a department of agriculture and physiography, which is in charge of E. E. Balcomb. It has begun publishing a Teachers' Bulletin on Agriculture and School Improvement, which is sent free to teachers and others interested in such work. The December and January numbers of this bulletin contain suggestions for teaching agriculture, taking up in some detail such matters as seed testing, grafting, and budding, and giving directions for organizing local branches of the School and Home Improvement League.

Agriculture in Public High Schools.—The Sac City, Iowa, High School has introduced an agricultural course which has an enrollment of 56 pupils. The Higginsville, Mo., High School has a class of 38 boys and girls studying elementary agriculture.

Simmons College Domestic Science Department.—Simmons College, Boston, according to a note in the February *Everyday Housekeeping*, has recently taken over the property and management of the Boston Cooking School, and has established a regular four-year course in domestic science and a one-year course for those who do not wish to devote more time to this study. Cooking, sewing, marketing, elementary chemistry, bacteriology, nutrition, and other subjects will be included in the curriculum.

Philippine Bureau of Forestry.—The Philippine Reorganization Act, which has been approved by the governor-general, provides that the chief of the bureau of forestry shall hereafter be known as the director of forestry. The position of assistant chief and the division of forest inspection are abolished, the work of the forest inspection being transferred to the bureau of internal revenue. This transfer will permit of the foresters in the different districts devoting their entire time to the sylviculture study of the forests, the location of areas best suited for the commercial exploitation of timber and minor forest products, and the inspection of logging operations of various licensees. A recent order provides that for a period of 5 years the residents of the islands shall be allowed to utilize, free of charge and without license, forest products for personal use, trees of the first group excepted. Timber cut for sale will be paid for as heretofore.

At present there are 8 American trained foresters and assistant foresters in the islands, and others are expected early in 1906.

Scientific Commission to Study Rural Hydraulics.—A recent report of the Secretary of Agriculture to the President of France, reviewed in *Journal d'Agriculture Pratique*, recommends that the commission for scientific studies be increased from 16 to 24, in order to carry out the order of last March, directing the study of surface and underground waters. He recommends that the work should not be limited, as hitherto, to the problems of irrigation and drainage, but should include detailed studies of rainfall, runoff, and watersheds, in their relation to water power, and special attention should be given to underground supplies for towns. In the latter connection he says: "Without hoping to discover precise mathematical laws for such complex phenomena, we may still hope that after collecting a large mass of reliable data, they may be so grouped and coordinated as to furnish a fair guide to engineers engaged in developing underground waters."

A New Testing Station for Farm Machinery.—The machine-testing commission of Hanover, Germany, has decided to enlarge its sphere of activity to include a permanent testing station, which is to be in charge of Prof. Alwin Nachtweh. The new station will be located in the city of Hanover.

International Windmill Convention.—According to an item in *Journal d'Agriculture Pratique*, the Secretary of Agriculture of France has called together that part of the commission for scientific study which is employed in investigating wind power for irrigation and other pumping. M. Angot of the interior meteorological office has

been engaged in finding a new design for registering anemometers, and has had three made for precise work. M. Ringelmann, director of the station for testing machinery, has undertaken to arrange an international convention which the commission believes will have a very beneficial effect on manufacturers of windmills for raising water. The arrangements have met with the approval of the Secretary of Agriculture.

Agricultural Exposition in Paraguay.—The National Agricultural Society of Paraguay will hold an exposition at Asuncion, beginning May 15, 1906. The exposition will include exhibits of live plants, fruit, and cultivated plant products, rural industries, dairy industries, poultry and apiculture, and sericulture.

Miscellaneous.—It is learned from *Nature* that a number of men interested in agricultural problems recently gathered at Christiania, Norway, under the presidency of Prof. John Sebelien, to celebrate the acquisition of national independence. A fund was started for the purpose of fostering research in Norwegian agriculture, to which all Norwegians both at home and abroad have been invited to subscribe. When the sum reaches 15,000 crowns (about $4,000) it is proposed to offer prizes for essays on particular questions, and to reward Norwegian scientific work in certain branches of learning; and later it is the intention to give direct financial aid to research work in agricultural science.

The government of the Gold Coast has established experimental cotton farms at Anum and Labolabo, for the purpose of testing varieties of cotton and determining the best time of planting cotton for that region.

The Botanical and Agricultural Department of the Gold Coast provides annually an elementary course in theoretical and practical agriculture at the Aburi Garden to train teachers in agriculture for the public schools. The department also maintains apprenticeships to prepare young men for subordinate positions in the department or for overseers of farms and plantations.

The agricultural chemical experiment station at Spalato, Austria, has been provided with commodious and thoroughly modern quarters in the new building of the Royal Agricultural Institute for Teaching and Experimentation. An illustrated description of the new building is given in the January issue of *Zeitschrift für das Landwirtschaftliche Versuchswesen in Oesterreich.*

Prof. S. P. Langley, secretary of the Smithsonian Institution in this city, died February 27.

Dr. A. W. Harris, formerly director of this Office, and at present director of the Jacob Tome Institute at Port Deposit, Md., has been elected president of the Northwestern University. Dr. Harris will enter upon his new duties in the fall.

The death is announced of Dr. H Ritthausen, professor of agricultural chemistry in the University of Königsberg until his retirement in 1900, and widely known for his investigations upon the albuminoids.

Prof. A. Zimmermann, director of the biological agricultural institute at Amani, German East Africa, has been appointed director of the agronomic station at Salatiga, Java.

Dr. Friedrich Petersen, an official of the Prussian Ministry of Agriculture at Berlin, is traveling in this country for the purpose of studying the breeding of cattle and horses especially, and agricultural conditions in general.

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EXPERIMENT STATION RECORD.

Vol. XVII. April, 1906. No. 8.

The passage of the "Adams Act" will be generally recognized as marking a new era in agricultural investigation. It not only opens up new possibilities to the experiment stations, but its passage indicates the widespread interest in scientific agriculture, which will serve to make their efforts more effective.

The new appropriation is a distinct tribute to the work and influence of the experiment stations, and to the place which they have won in the appreciation of the people. A few years ago it would have been well-nigh impossible. But the stations have demonstrated their usefulness to the satisfaction of the most skeptical, and through their publications and their public speaking have waged a great campaign of education whose influence has become very potent. The confidence now felt was reflected in not only a sympathetic but an aggressive attitude for the passage of the increased appropriation.

From the time Mr. Adams introduced his bill two years ago, it had the cordial support of representative farmers, their organizations, and the agricultural press. Rarely has a measure making a continuous demand upon the Treasury met with less opposition in Congress. Hardly a voice was raised against it on the floor of the House, and in the Senate there was unanimous consent to its consideration and no opposition to its passage on the final vote. As passed the act is practically in the form in which it was submitted at the beginning of this session of Congress. Great credit is due its author for the skill and devotion with which he labored for this measure, and prepared the way for its unanimous passage.

Great changes have come about since the Hatch Act was passed—greater and more far-reaching than we realize until we pause to compare the condition of knowledge then and now. At that time the practice of agriculture was governed to a very large extent by empirical rules. The subject was not differentiated either in the agricultural college or the experiment station, and apparently the need of such differentiation was not felt because there was not the necessary basis for it.

There were very few standard books dealing with the principles and practice of agriculture and horticulture. Farmers' institutes were largely social or political gatherings instead of schools for the farmers, and if a seed-corn special or a dairy special had been run it would have attracted small attention. The general attitude toward experimentation and science in agriculture was decidedly skeptical. The idea that there was something occult or which could not be fathomed or explained in successful agricultural practice still had a considerable hold.

The eight or ten experiment stations maintained in as many States received only small support from their States, and to a quite large extent were engaged in inspection work. A college or station dairy building, or an insectary, or an agronomic laboratory was as unheard of as a respiration calorimeter. The equipment was meager and the working force quite limited. In only twelve States had a need been felt for a fertilizer control, which to-day is exercised in thirty-four States and applies to an industry amounting to more than $50,000,000 a year. There was no feeding-stuffs control, no inspection of nursery stock or seeds or creamery apparatus or insecticide materials, and no laws for the control of San José scale or other insects and diseases dangerous to agriculture.

At that time there was no simple method for testing milk, as a means for measuring the value of individual cows and as a basis for paying for milk at creameries. The basic principles underlying dairying were far from being known—that cream ripening is due to special cultures of bacteria which affect the quality and the flavor of the product, that the cheese value as well as the butter value of milk is largely dependent on the fat content, that cheese ripening is due to well-defined organisms and conditions, that cold curing of cheese is not only practicable but a great safeguard to the product, and that many cases of inferior product are due to faults of the milk which may be avoided by the curd test. Sanitary and pasteurized milk were almost unknown; the various causes which contribute to unclean and unhealthy milk were but little understood.

It was not known that clovers and other legumes are able to store up the nitrogen of the air in their growth, much less that this ability is due to a symbiotic relation between the plants and bacteria on their roots; that atmospheric nitrogen may be made available to plants by several other means; and that nitrification and denitrification are very important processes in relation to plant nutrition, and are accomplished by micro-organisms in the soil whose activity is controlled by a variety of conditions. The theory of tillage and its value for conserving moisture was far from being understood, as were also the use of fertilizers and the requirements of crops under irrigation.

There was little conception of the possibilities of plant breeding and selection, to improve such common crops as corn and the cereals,

change their composition, and adapt them to different localities and purposes and a shorter season of growth. Dry farming as we now know it was not heard of, and the crops which have to a large measure made it a success had not been introduced or disseminated in this country. The theory and practice of silage making had not been worked out, and the place of silage in farm economy was only partially appreciated. The same was true of a wide range of feeding stuffs, and the effects of different feeds, most advantageous combination, the period of profitable fattening and many other matters relating to feeding were quite largely matters of tradition. We did not know that hens differ as greatly in productive power as milch cows, and that the egg-laying habit could be largely developed by selection.

We did not know that Texas fever could be eradicated, or that tuberculosis could be weeded out of a herd and animals inoculated against it; we had no conception of the extent to which plant diseases and injurious insects could be held in check by seed treatment, by spraying the crop, and by various other means which have been devised and have become a part of good farm practice. The country was not aroused to the dangers of depleting our forests, and there were no forest schools. Large amounts of by-products from various industries which are now turned to use for agricultural purposes were allowed to go to waste. We did not know that the date palm could be grown commercially in Arizona, macaroni wheats in the semiarid Northwest, alfalfa in the South and many parts of the East, and the sugar beet over a wide belt of country; that Alaska had any agricultural possibilities, or that an experiment station could be of great advantage to even the primitive agriculture of the range.

Some of the things which it was thought were known were supported by imperfect data, and the conclusions were far from secure. And most important of all, only a small proportion of what was known found application in the practice of the average farmers.

This remarkable advancement is, of course, not due to any single group of agencies. It is the combined product of a great variety of institutions all over the world, some of them working in pure science and others in its special applications. But in all of this modern development of a more rational and scientific basis for agriculture, the American experiment stations, and the National Department of Agriculture, which forms an integral part of the experiment station system in this country, have been a conspicuous and very essential factor.

Many classes of problems which the stations had to face nineteen years ago are now settled in most States. Questions of organization and the responsibilities of the States have worked themselves out. It has been shown that the farmers can be reached and their confidence won to such an extent as to form the basis for a substantial and influ-

ential public sentiment, which will give encouragement and support to the stations in their legitimate work and prevent outside interference. This in reality is one of the most remarkable results of the experiment station movement, and it is by no means confined to the older States of the East where agriculture is more highly developed and specialized. The newer States, with no deeply grounded traditions of farm practice and with crude methods and conditions, have been quite as ready to embrace the work of the stations and to look to them for advice and aid.

In no other country does the experiment station occupy the same position in its relations to the people that it does in America. In the form in which we know it, it is distinctly American. It is this that makes it of special interest to foreign visitors; but transplanted to another country it becomes a quite different thing, because of the difference in environment. It is a product of American institutions and American ideals. The great value of its services in the past is attested on every hand, but those who have studied the station movement in its relations to future development feel that an even more important field is open to it.

This field the Adams Act prepares the stations to occupy. It will relieve them in some directions but will impose new responsibilities upon them. To a large extent it provides for a new order of work only possible to a limited extent before. The Adams Act differs from the Hatch Act in the more restricted application to be made of the funds. It provides specifically for the fundamental investigations of original character which the work of the past few years has brought out such a glaring need of. It is in many respects modeled on the second Morrill Act, being "for the further and more complete endowment, support, and maintenance" of the stations, to the end that they may conduct "original researches or experiments bearing directly on the agricultural industry of the United States."

The evident intention was to provide a research fund, and not merely to supplement the Hatch fund. The latter is more general in its provisions, and is applicable to a wider range of uses. While it has been a great stimulus to agricultural investigation, it has not been practicable, perhaps not advisable, to restrict it except in a quite general way. It has been employed for many purposes for which the Adams fund obviously can not be. This difference between the Hatch and Adams acts may not always be apparent to the general public. It is all the more important, therefore, that the distinction should be clear in the minds of those charged with station work.

The great service which the stations have been able to render to agriculture is a product of investigation and research, more or less remote, carried on somewhere and at some time, which has become a part of the sum total of our knowledge. The more elementary testing

and experimenting, important as it has been, has been merely the attempt to apply to local conditions and needs or to introduce into practice these general principles which have been previously worked out, together with the result of accumulated experience. The station worker who has not taken account of these facts has been either an imitator or an indifferent experimenter.

The new fund will call for sharper discrimination between different kinds of work. If held strictly to the purposes specified in the act it will give a great opportunity for placing the American stations on a high level as research agencies, and give them a leadership in developing the science of agriculture. It is the greatest opportunity for continued systematic research along agricultural lines which has ever been presented in any country, and this opportunity and the realization of the ultimate importance of investigation should be the inspiration of every station man and every friend of agricultural advancement. It should be a strong incentive to the careful choice of problems to be investigated, thorough and exhaustive work in their solution, and the securing of permanent and far-reaching results.

The best use of the fund in the different States will call for wise administration and the selection of men with a genius for agricultural investigation. The Adams fund roll might well be regarded as in a sense an honor roll, made up of men who have been selected on account of demonstrated special ability and qualifications for research work. The standard should be set as high as the available supply in this country will permit, and the outlook should furnish an additional incentive to men with taste and ability for research to prepare themselves thoroughly for their work.

Many of the stations have been planning in advance lines of investigation to be inaugurated under the new act. Many of these lines were not conceived of when the Hatch Act was passed, and would have been impossible in the state of knowledge then existing. This indicates how opportune the new grant is, and shows how wise the provision to confine it to advanced work. The granting of a comparatively small initial appropriation, with an annual increase for five years, will allow the stations to adjust themselves to the new work and to plan economically.

The Hatch fund will continue to cover some of the elementary work which will appeal more immediately to the farmers' needs, the adaptation of principles to local conditions, and the working out of improved methods. The research under the new act will extend the basis for demonstration and verification experiments leading to general improvement of farm practice in many directions. But more and more the States will be called upon to make provision for the local demonstrations intended to bring facts home to the farmer, the cooperative

experiments to arouse his interest and teach him how to apply results, and propaganda work looking to the establishment of special agricultural industries, as it does now for the farmers' institutes and for branch stations.

This added responsibility of the States was brought out in the report of the committees in Congress in presenting the Adams bill, which states that while the bill places the responsibility for additional work upon the various stations, it "will necessitate a corresponding increase of appropriation from the various States because of the additional work provided for."

This is further emphasized in the circular letter of the Secretary of Agriculture, relating to the administration of the Adams Act. In this the Secretary says: "The increased liberality of the Federal Government in providing for the endowment of research and experimentation in agriculture should be a further incentive to the States and local communities to supplement these funds for the extension of demonstration experiments, farmers' institutes, agricultural colleges, schools, and courses of instruction, and the general education of the rural communities along industrial lines, in order that the masses of our farmers may be so educated from early youth that they will appreciate the benefits of original research and experimentation as applied to agricultural problems, and be able to appropriate in the most effective manner for their own benefit and the general welfare of the Nation whatever practical results are obtained from the work of the agricultural experiment stations."

In this way the greatest permanent benefit will be conferred, and agriculture will more rapidly be placed upon an intelligent and scientific basis.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Some observations on the determination of citric-acid soluble and total phosphoric acid in Thomas slag, F. MACH (*Landw. Vers. Stat., 63 (1905), No. 1-2, pp. 81-91; abs. in Chem. Centbl., 1906, I, No. 1, pp. 85, 86; Jour. Chem. Soc. [London], 90 (1906), No. 519, II, p. 50*).—Comparative tests of Wagner's method and of the official method of the German association of experiment stations for determining citric-acid soluble phosphoric acid are reported.

The results by the two methods as a rule agreed quite closely, but occasionally the Wagner method gave higher results than the official method, in which silica is removed before precipitation of the phosphoric acid, and higher than the molybdic method, especially in slags rich in silica. The method of evaporating only to a sirupy consistency proposed by A. Bömer gave similar results. The thorough removal of silica previous to precipitation of phosphoric acid is considered essential to accuracy.

The Schenke modification of the citrate method for determining total phosphoric acid (E. S. R., 17, p. 6) was found to give results in the author's opinion too high, indicating that it should be further tested before it is substituted for the ordinary method.

A simple method of determining phosphoric acid, potash, sodium, calcium, and magnesium in hydrochloric-acid soil solutions, H. NEUBAUER (*Landw. Vers. Stat., 63 (1905), No. 1-2, pp. 141-149; abs. in Chem. Centbl., 1906, I, No. 1, p. 83*).—The method described is based upon the fact that when the hydrochloric-acid solution of a soil is evaporated to dryness and carefully heated the iron and aluminum chlorids are converted into insoluble oxids, the calcium and magnesium chlorids are but slightly affected, and the chlorids of the alkalis are not altered.

The evaporation to dryness (with addition of a small amount of calcium carbonate if this constituent is deficient in the soil) removes iron, phosphoric acid, and silicic acid, and furnishes a solution in which potash and soda may be determined directly by the author's method.[a] Phosphoric acid is determined by the molybdic method in the residue from the potash determination. For the determination of calcium and magnesium another portion of the hydrochloric-acid solution is evaporated to dryness and heated until all trace of acid disappears and calcium is determined in the water extract of the residue by precipitation with ammoniacal ammonium oxalate and magnesium in the filtrate from the calcium precipitate by precipitation with sodium phosphate.

The method is not reliable in case of soils containing large amounts of sulphates. There is danger of injury to platinum dishes due to the formation of free chlorin in the heating of the chlorids in the residue from evaporation. The results of the potash determinations are not very satisfactory in case of soils poor in potash. The addition of a small amount of potash-free calcium chlorid to the soil solution before evaporation was found to increase the accuracy of the potash determinations.

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[a] Ztschr. Analyt. Chem., 39 (1900), p. 481.

Titanium, H. PELLET and C. FRIBOURG (*Ann. Sci. Agron., 2. ser., 10 (1905), II, No. 1, pp. 20–84*).—This article deals with the properties of titanium and its different compounds, studies of different methods employed in the separation and determination of titanic acid and of the presence and determination of titanic acid in soils and plants, especially in sugar cane and sugar beets.

The authors found 2 per cent of titanic oxid in an Egyptian soil used for the cultivation of sugar cane and 0.47 per cent in a French soil used for the culture of sugar beets. They refer to Maxwell's work, indicating the occurrence of considerable amounts of titanic oxid in sugar cane and report the occurrence of 0.17 per cent of this substance in the ashes of sugar cane which contained, however, a small amount of soil. In ashes of sugar cane and sugar beets prepared with great care they were not able to find any titanium.

The determination of titanic acid in soils and ash of plants, H. PELLET and C. FRIBOURG (*Ann. Chim. Analyt., 10 (1905), No. 11, pp. 413–416; Bul. Assoc. Chim. Sucr. et Distill., 23 (1905), pp. 67–71; abs. in Chem. Centbl., 1905, II, No. 16, pp. 1193, 1194*).—A colorimetric method and a gravimetric method are described. The first is based upon fusion with hydrofluoric acid and hydrogen potassium sulphate, sulphuric acid solution of the fusion being treated with hydrogen peroxid and tested in comparison with solutions of known strength in a Josse colorimeter. The second method is based upon fusion in a similar manner, partial neutralization with potassium hydroxid, and boiling with hydrochloric acid, the titanate precipitated being washed with a 2 per cent potassium carbonate solution.

The influence of the presence of titanium on the determination of aluminum in presence of iron oxid and phosphoric acid by the principal methods employed at the present time, H. PELLET and C. FRIBOURG (*Ann. Chim. Analyt., 10 (1905), No. 11, pp. 416–420*).—Investigations are reported which show that the presence of titanic acid affects the accuracy of the Carnot method for aluminum, and all others in which aluminum phosphate is precipitated, and should be determined by the colorimetric method noted above and correction made accordingly.

Occurrence of alumina in plants, H. PELLET and C. FRIBOURG (*Ann. Chim. Analyt., 10 (1905), pp. 373–376; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 518, II, pp. 860, 861*).—Alumina was found in only very minute quantities in sugar cane and sugar beets. In determining the alumina, the hydrochloric-acid solution freed from silica in the usual way was neutralized with ammonia and oxidized by the addition of a few crystals of potassium chlorate. Ammonium phosphate and ammonium thiosulphate were then added in the proportion of 2 gm. of the former to 10 gm. of the latter and the mixture boiled for 15 minutes. Acetic acid in proportion of 15 gm. was afterwards added, the precipitate of aluminium phosphate being collected on a filter, ignited, and weighed.

Methods of organic analysis, H. C. SHERMAN (*New York and London: The Macmillan Co., 1905, pp. XII+245*).—In this volume, which is designed as a text-book for college and university use, it has been the author's purpose to give introductory instruction in organic analysis with special reference to plant and animal substances and their manufactured products.

The greater part of the book is devoted to quantitative methods for food materials and related substances, a feature of the work being the numerous references to the publications of the Association of Official Agricultural Chemists and the attempt to follow as far as possible the nomenclature in such publications.

As a whole the work constitutes a valuable handbook for students of analytical chemistry, particularly as related to carbohydrates, acids, oils, fats, waxes, fatty oils, butter, soaps and lubricants, proteids and cereals, milk, preservatives, etc. Throughout the text numerous references are made to the literature of the subject and the volume also includes a complete index.

A new method for the quantitative estimation of sugar with the Zeiss immersion refractometer, B. WAGNER and A. RINCK (*Chem. Ztg., 30 (1906), No. 5, pp. 38, 39*).—The authors claim that the use of the immersion refractometer for determining sugar is more accurate, more rapid, and more economical of time and material than gravimetric methods. The possibilities of the method for the determination of calcium, aluminium, iron, zinc, etc., are also spoken of.

Globulin, J. MELLANBY (*Jour. Physiol., 33 (1905), No. 4-5, pp. 338-373, figs. 16*).—The conclusions drawn from a series of investigations on the solution of globulin by neutral salts, the precipitation of globulin from such solutions, and related questions follow:

"Solutions of globulin by a neutral salt is due to forces exerted by its free ions. Ions with equal valencies, whether positive or negative, are equally efficient, and the efficiencies of ions of different valencies are directly proportional to the squares of their valencies.

"The amount of globulin dissolved by a given percentage of neutral salt is directly proportional to the strength of the original globulin suspension.

"The precipitation of globulin from solution in neutral salts by neutral salts depends upon a molecular combination between the salt and globulin, the compound so formed being stable only in excess of the combining salt. Precipitation by salts of the heavy metals depends upon the formation of a stable salt globulin compound.

"Solution of globulin by acids or alkalies is of the nature of a chemical combination. The relative solvent efficiencies of strong acids and alkalies are of the same order as their chemical avidities."

The cleavage of edestin of cotton seed by pancreatic juice, E. ABDERHALDEN and B. REINBOLD (*Ztschr. Physiol. Chem., 46 (1905), No. 1-2, pp. 159-175*).—When cleavage was induced by treating the edestin of cotton seed with pancreatic juice, the proportion of dialyzable material not precipitated by phosphotungstic acid increased with the time of the reaction, while the proportion of the material precipitated by phosphotungstic acid increased at first and then decreased. Tyrosin, glutaminic acid, leucin, alanin, and aspartic acid and trytophan were isolated from the cleavage products; also traces of phenylalanin. No glycocoll nor α-pyrrolidin carbonic acid was found.

Carbon tetrachlorid with special reference to its use as a solvent in the extraction of fat and in similar ways, B. M. MARGOSCHES (*Der Tetrachlorkohlenstoff, unter besonderer Berücksichtigung seiner Verwendung als Lösungsbzw. Extraktionsmittel in der Industrie der Fette und verwandter Gebiete. Stuttgart: Ferdinand Enke, 1905, pp. 115; rev. in Österr. Chem. Ztg., 8 (1905), No. 24, p. 571*).—A monograph on carbon tetrachlorid summarizing the literature from a historical, chemical, and technological standpoint. The work as a whole constitutes a bibliography of the subject.

A laboratory handbook for the analysis of milk, butter, and cheese, J. R. EVANS (*[New York], 2. ed., pp. 60*).—This is a brief outline of useful methods with no attempt at interpreting results. The author states in the preface that "during the past year a rigid investigation was undertaken for the purpose of determining the comparative value of the various 'milk testers,' with the result that the lactoscope, creamometer, pioscope, lactobutyrometer, and the lactometer, when used alone, were found absolutely worthless in the testing of a milk."

The application of "sin-acid" butyrometry to sheeps', goats', and cows' milk, C. BEGER (*Milchw. Zentbl., 1 (1905), No. 12, pp. 547-551*).—Comparative determinations by the Gerber and the Sichler non-acid methods on the three kinds of milk are reported.

Considerable difficulty was experienced in testing milk preserved with formalin by the Sichler method. For ordinary purposes the non-acid method in its present form is not considered as satisfactory as the Gerber method, and for the chemist the use of acid as in the Gerber method can scarcely be considered a disadvantage.

Contribution to the cryoscopic examination of milk, O. ALLEMANN (*Landw. Jahrb. Schweiz, 19 (1905), No. 8, pp. 499-502*).—Cryoscopic examinations of 23 samples of milk of known purity showed on an average a freezing point of −0.571° C., while 11 samples to which 2 per cent of water had been added showed an average freezing point of −0.554°, 11 samples to which 5 per cent of water had been added −0.536°, 11 samples to which 10 per cent had been added −0.500°, and 11 samples to which 20 per cent had been added −0.457°.

This method in the hands of the expert analyst is believed to be very valuable in the detection of added water in milk, due attention being paid to the acidity of the milk and the possibility of the addition of preservatives which might affect the results. On account of the skill and time required, this method is not considered as useful in routine work as determinations of the specific gravity and fat.

A method for the determination of hydrogen peroxid in milk, together with some observations on the preservation of milk by this substance, S. AMBERG (*Jour. Biol. Chem., 1 (1906), No. 2-3, pp. 219-228*).—The author has made use of the method proposed by Richardson and which is based upon the color reaction produced by a solution of titanium hydrate in sulphuric acid in the presence of hydrogen peroxid. The method as applied by the author to milk was found to be accurate when the hydrogen peroxid was present in quantities even as small as 1:5,000. It is noticed that salicylic acid causes a color reaction which can scarcely be distinguished from that product by hydrogen peroxid.

It was found that boiled milk uses up a certain amount of hydrogen peroxid independently of catalytic and bacterial action, and the idea is advanced that this may be due to the production of reducing substance by boiling. The literature relating to the use of hydrogen peroxid for the preservation of milk is reviewed and the objections which have been raised to this method are noted. The author concludes that although the efficiency of hydrogen peroxid in sterilizing milk in all cases has not been established, and although the amount required for preserving milk for any given length of time is uncertain, the harmlessness of the method seems to justify its trial as a milk preservative.

The identification of boric acid, O. VON SPINDLER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 8, pp. 478-482, fig. 1*).—Recently published data on the determination of boric acid are summarized, and a new form of apparatus described for conveniently determining boric acid by the flame test.

Formaldehyde and its reactions, J. SCHUCH (*Ztschr. Landw. Versuchw. Oesterr., 8 (1905), No. 11, pp. 1058-1060*).—The author tested several methods for the determination of formaldehyde concluding that the Arnold and Mentzel method is the best for the detection of formaldehyde in wine.

METEOROLOGY—WATER.

Report of the Chief of the Weather Bureau for 1905, W. L. MOORE (*U. S. Dept. Agr., Weather Bur. Doc. 338, pp. 37*).—This report contains a review of 10 years' work of the Bureau under the present chief, as well as an account of work of the year 1905, with recommendations.

It is stated that the Bureau "has made such progress in its internal discipline and in the results accomplished for the benefit of the farmer, the mariner, the shipper, the manufacturer, and the seeker after health or pleasure, that there is no weather service anywhere in the world comparable with it." It has developed and put into effect a fair, yet rigid, discipline for the control of its personnel and a system of study and examination which develops the intellectuality of those who receive advancement. "With such a discipline it has, with rare exceptions, given timely warning of the coming of injurious changes in temperature, and allowed no important storms or floods to come unannounced."

It has encouraged the study of meteorology in educational institutions by allowing its scientists, outside of their official duties, to deliver courses of lectures to students, so that there are now twenty institutions of learning where meteorology forms a part of the curriculum, thereby giving preliminary training to the young men who, in after years, will succeed to the duties now performed by the meteorologists of the Government.

Three years ago the Bureau began the establishing, at Mount Weather, Va., of an institution devoted purely to meteorological research. This observatory was established to enable the Bureau to raise its work in meteorological research to the same plane as that occupied by its work in practical meteorology. The plant is especially adapted to atmospheric research and is equipped with a physical laboratory in which all questions which yield to treatment by experiment as distinct from pure observation can be investigated. An outline is given of lines of investigation which may be profitably undertaken in the laboratories of the Mount Weather observatory.

Monthly Weather Review (*Mo. Weather Rev., 33 (1905), Nos. 10, pp. 433–470, fig. 1, charts 10; 11, pp. 471–514, fig. 1, charts 11*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of October and November, 1905, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 10.—Special contributions on The Ziegler Relief Expedition, by O. L. Fassig; Standing Clouds Among the North Carolina Mountains, by F. W. Proctor; Sounding and Pilot Balloons over the Ocean, by Prince of Monaco; Weather Bureau Cipher Codes, by E. B. Garriott; and notes on meteorology of the planet Mars. Mr. Harry B. Wren, Eiffel's "Études pratiques," methods of teaching meteorology, the rainfall of Mexico, temperatures on Mount Rose, Nev., protection from frost, publication of thermograms in facsimile, structure of hailstones, the pagoscope versus the daily weather map, Weather Bureau men as educators, meteorology in colleges and universities, meteorology in German universities, unusually early snow in Alaska, and the deflection to the right (illus.).

No. 11.—Special contributions on The Importance of a Well Written Synopsis of Weather Conditions, by N. R. Taylor; Results of the Work Done at the Aeronautical Observatory of the Royal Prussian Meteorological Institute, from January 1, 1903, to December 31, 1904, by S. Hanzlik; Highest Kite Ascension, by C. F. Marvin; The Rainfall of China and Korea (illus.), by T. Okada; The Development of Meteorology in Australia, by A. Noble; Storm Warnings for Lake Vessels, by E. B. Garriott; and notes on a guide to the observation of earthquakes, Indian summer, a lecture on snow crystals, physical societies and journals, cold and heat, meteors—their incandescence and their noise, meteorological literature in the public libraries, standard time at Key West, influence of location on the winds, and a mistake about atmospheric dust.

Meteorology and climatology, W. TRABERT (*Meteorologie und Klimatologie. Leipsic: Deuticke, 1905, pp. 127, figs. 37; rev. in Nature [London], 73 (1905), No. 1885, p. 149*).—This book forms part 13 of Klar's "Die Erdkunde," and outlines the general principles of meteorology and their application to the study of climate. It deals with the meteorological elements and the making and reducing of observations, atmospheric physics, the distribution of temperature and its variations, the circulation of the atmosphere, evaporation and condensation, weather and climate, including weather forecasting, types of climate, and the climatic characteristics of the main land divisions of the globe.

Meteorological chart of the Great Lakes, A. J. HENRY and N. B. CONGER (*U. S. Dept. Agr., Weather Bur., Met. Chart Great Lakes, 1905, No. 1, pp. 19, pl. 1*).—This is a summary of observations on the meteorological conditions of the winter of 1904–5 in the lake region, with notes on the opening of the navigation season of 1905,

ice during the winter of 1904-5 at different points on the Great Lakes, and display of storm signals on the lakes.

Temperature and relative humidity data, W. B. STOCKMAN (*U. S. Dept. Agr., Weather Bur. Bul. O, pp. 29, charts 2*).—This pamphlet consists of a series of tables which show for each month of the year and for each Weather Bureau station that has been in operation at least six years, the highest and lowest temperatures, respectively, that have been observed from the beginning of observations until the end of 1904; the monthly and annual mean maximum and mean minimum temperatures, and monthly and annual mean relative humidity.

A preliminary investigation of the more important features of the meteorology of southern Asia, the Indian Ocean, and neighboring countries during the period 1892-1902, J. ELIOT (*Indian Met. Mem., 16 (1905), pt. 2, pp. 181-307 + XLVII, pls. 22; rev. in Nature [London], 73 (1905), No. 1884, pp. 136, 137*).—It is stated that the period covered by this report "was unique in the meteorology of India for the magnitude and persistence of the variations of rainfall, cloud, humidity, and temperature from the normal."

For the purposes of discussion the period covered is divided into 2 parts, abnormal in opposite directions, (1) 1892-1894, characterized by excess of rain, cloud, and humidity, and a reduced temperature, and (2) 1895-1903, characterized by deficient rainfall, less cloud, drier air, and an average temperature above the normal. The normal annual rainfall for the period, calculated from data from 450 stations, was 41.09 in. The normal rainfall for the 3 years above noted as abnormally wet was 123 in., the total rainfall for the period being 143.5 in., an excess of 20.5 in. The total rainfall for the 8 years 1895-1902 was 303.8 in., a deficiency of 24.9 in. It appears that all seasons of the year were affected by these abnormal conditions.

Not only India, but other countries—Australia and South Africa—depending upon the Indian Ocean for their rain, were in excess during 1892-1894 and deficient during 1895-1902. Long-period barometric variations were similar in direction, amount, and epoch for all India. There was apparently a 2-year period of barometric oscillation. Observations with a black bulb thermometer indicate that during 1891-1897 there was an excess of solar radiant energy and during 1898-1902 there was a deficiency. The period of deficient rainfall was characterized by droughts and famines.

An appendix contains reports on two of the latter (in 1897 and 1900) as well as detailed data relating to seasonal rainfall, rainy days, pressure, and dates of commencement and ending of monsoon rains.

British rainfall, 1904 (*London: Edward Stanford, 1905, pp. 88 + 279, pls. 8, figs. 14*).—This, the forty-fourth annual volume on British Rainfall, is compiled by H. R. Mill, and is based upon the records of 3,982 rain gages distributed throughout Great Britain and Ireland.

It includes "(1) a report touching on the work of the rainfall organization; (2) original articles discussing the rainfall of Ben Nevis, the driest Octobers on record, and the twenty-four years' records of duration of rainfall at Camden Square; (3) tables of duration of rainfall, amount of evaporation, and representative records of daily rainfall (a new feature) at selected stations during 1904; (4) an account of the staff of observers, and a list of the changes in the stations; (5) a record of the losses of observers by death, with a few biographical notes; . . . (6) the observers' remarks on rainfall and weather; (7) a discussion of heavy falls of rain with a minute investigation of the distribution of rainfall on the wettest days; (8) discussions of droughts, rainy spells, number of rainy days, and intensity of rainfall at selected stations; (9) a general discussion of the relation of the monthly and annual rainfall to the average; and (10) the general table of annual rainfall at all stations, together with the names of the observers or responsible authorities."

The report records the discontinuance, October 1, 1904, of the observations on Ben Nevis, the highest possible site in the British Isles, which began in 1883, as well as at Fort Williams, 4 miles away and 4,400 ft. below the summit of Ben Nevis.

Chlorin in rain water (*Agr. Students' Gaz., n. ser., 12 (1905), No. 5, p. 172*).—This is a brief summary for the 6 months and for the year ended September 30, 1905, of the usual observations at the Royal Agricultural College at Cirencester on rainfall and its chlorin content.

"The rainfall for the 6 months was 13.44 in., falling on 83 days; it contained a mean of chlorids equivalent to 0.277 gr. sodium chlorid per gallon, i. e., equal to a deposit of 11.96 lbs. of common salt per acre. The rainfall for the 12 months was 23.66 in., on 172 days, and it contained chlorids equal to 26.8 lbs. of common salt per acre."

Composition of Barbados rainfall (*Rpt. Agr. Work, Imp. Dept. Agr. West Indies, 1902–1904, pt. 1, p. 3*).—A table is given which shows the total amount and contents of chlorin, total nitrogen, nitrogen as ammonia, and nitrogen as nitrates in the rainfall at Dodds during the period from December, 1902, to May, 1904. The total rainfall during the period was 103.62 in., supplying approximately 272 lbs. of chlorin and 15 lbs. of nitrogen per acre.

A contribution to the rainfall régime of the region of Boulogne, G. Ventura (*Gior. Gen. Civ., 1905, Jan.*).—This report gives an account of studies on the relation of the rainfall to canal and drainage systems in a part of this region.

Rainfall in the agricultural districts, G. G. Bond (*Queensland Agr. Jour., 16 (1905), No. 3, p. 288*).—A table is given which shows the total rainfall for each month from October, 1904, to October, 1905, inclusive, in 41 agricultural districts of Queensland.

Thunder and lightning, C. Flammarion, trans. by W. Mostyn (*London: Chatto & Windus, 1905, pp. 281; rev. in Nature [London], 73 (1905), No. 1887, p. 196*).—This is an abridged translation of Flammarion's *Les phénomènes de la foudre*. The greater part of the book is devoted to the effects of lightning strokes on man, animals, trees, plants, metals, houses, etc.

The pulse of the atmospheric circulation, W. N. Shaw (*Nature [London], 73 (1905), No. 1886, pp. 175–177, fig. 1*).—This article discusses the relation between the pulsations of the southeast trade wind as measured during a long period at St. Helena and the rainfall of northwestern Europe. Such a relation is believed to be clearly shown by the available data which are summarized and charted.

Investigation of the upper air (*Nature [London], 73 (1905), No. 1885, p. 162*).—A brief announcement regarding the proposed work of the British Meteorological Committee in the investigation of the upper air by kites and other means.

Improved methods for finding altitude and azimuth, geographical position, and the variation of the compass (*U. S. Dept. Agr., Weather Bur. Doc. 336, pp. 8, figs. 7*).—The methods proposed by St. Hilaire, Souillagouët, and Littlehales are discussed and explained with tables and charts.

Daily river stages at river gage stations on the principal rivers of the United States. Part VII, for the years 1900, 1901, 1902, 1903, and 1904, H. C. Frankenfield (*U. S. Dept. Agr., Weather Bur. Doc. 339, pp. 728*).—"This volume constitutes the seventh part of the series of river gage readings, the publication of which was begun by the Signal Service and has been continued by the Weather Bureau. The previous volumes are as follows: Part I. Stages of the Ohio River and of its principal tributaries, 1858 to 1889. Part II. Stages of the Mississippi River and of its principal tributaries, except the Ohio River, 1860 to 1889. Part III. Stages of water at miscellaneous river stations in California, Oregon, North Carolina, etc., 1875 to 1889. Part IV. Daily river stages at river gage stations on the principal rivers of the United States for the years 1890, 1891, and 1892. Part V. Daily

river stages at river gage stations on the principal rivers of the United States for the years 1893, 1894, and 1895. Part VI. Daily river stages at river gage stations on the principal rivers of the United States for the years 1896, 1897, 1898, and 1899."

A report on the underground waters of Louisiana, W. C. STUBBS, G. D. HARRIS, A. C. VEATCH, ET AL. (*Geol. Survey La. Bul. 1, pp. VIII + 164, pls. 10, figs. 12*).—This bulletin is divided into 2 parts, (1) the underground waters of southern Louisiana and (2) the underground waters of northern Louisiana and southern Arkansas. The work on the underground waters of Louisiana was begun by the State Geological Survey in 1899, and earlier reports on the subject have already been noted (E. S. R., 14, p. 428; 16, p. 722).

The first part of this bulletin is substantially a reprint of Water Supply and Irrigation Paper No. 101 of the U. S. Geological Survey (E. S. R., 16, p. 722). It deals with origin of artesian and deep-well waters in southern Louisiana, topography and stratigraphy of the region, subdivisions based on underground water conditions, well statistics, variations in flow and pressure head shown by wells in southern Louisiana, well drilling, and pumping.

The second part of the bulletin is a preliminary report on work carried on in 1902 and 1903 in Louisiana and adjoining States by A. C. Veatch, partially in the employ of the Louisiana State Survey and partly as assistant geologist to the U. S. Geological Survey. It gives a summary of the main results obtained in a study of the topography, stratigraphy, geological formations, and water horizons of northern Louisiana. A dictionary of altitudes in the same region is given in an appendix.

On the influence of summer rains on the flow of springs, HOULLIER (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 23, pp. 972, 973; abs. in Rev. Sci. [Paris], 5. ser., 4 (1905), No. 25, p. 783*).—This article discusses briefly the various factors which modify the relations between the rainfall and the flow of springs, such as the permeability of the soil, temperature, and movement of winds, cultural conditions, etc., of the basin feeding the springs.

Water softening at Oberlin, Ohio, W. B. GERRISH (*Engin. Rec., 52 (1905), No. 15, pp. 412, 413; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 12, Rev., p. 676, 677*).—A water-softening plant in which sodium carbonate and calcium hydroxid are used to remove hardness, due to carbonates and sulphates of calcium and magnesium, is described.

The sterilization of water by ozone, A. STEENS (*Engin. Rec., 53 (1906), No. 1, pp. 31, 32, figs. 4*).—This article describes the system proposed by Marmier and Abraham, in which water to be sterilized is passed through a vertical cylinder filled with concentrated ozone in such a way as to secure a thorough mingling of gas and water. The method is claimed to be very efficient.

Purification of water by copper sulphate, D. D. JACKSON (*Municipal Engin., 29 (1905), No. 4, pp. 245, 246; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 12, Rev., p. 675*).—An account is given of the successful use of copper sulphate, 1 part in 2,000,000 of water, to remove algal growths in ponds.

In experiments with *Bacillus coli communis* and *B. typhi abdominalis* it was found that 1 part of copper sulphate to 50,000 parts of water was required to kill the germs when fresh and virulent. One part of the sulphate in 1,000,000 of water will greatly attenuate the germs and render them much less harmful in time of typhoid epidemics. One part in 2,000,000 of water destroys the germs with the attenuation usually found in water. One part in 50,000, and even 1 part in 1,000,000, can, however, be detected by taste and might affect the consumer.

A new method for detecting pollution of drainage water, water of streams, and drinking water, L. HEIM (*Österr. Chem. Ztg., 8 (1905), No. 22, p. 521*).—An asbestos filter which has been successfully used for removing suspended matter from water so that the colorimetric determinations may be more accurately made is described.

Water supply and sewerage (*Ann. Rpt. Bd. Health Mass., 36 (1904), pp. 1-295*).—This is the annual report of the State Board of Health to the legislature, and includes accounts of advice to cities and towns regarding water supply, ice supplies, sewerage and sewage disposal, and pollution of ponds and streams; examination of water supplies; examination of rivers; water-supply statistics; and experiments on the filtration and purification of sewage and water at the Lawrence Experiment Station in 1904.

Examinations with reference to free and albuminoid ammonia, nitrates and nitrites, oxygen consumed, hardness, suspended matter, residue on evaporation, color, and odor are reported for a large number of samples of water from the water supplies of various Massachussetts towns, as well as similar data for water of various streams in the State. Data are also given showing the relation of rainfall to flow of streams.

The reports on experiments in purification of sewage present a large amount of data bearing on the storage of nitrogen in and removal from filters; nitrogen-disposal efficiency; loss of nitrogen in case of different kinds of filters; the relation of bacteria to the operation of filters and to sewage purification in general; and the bacteria in septic sewage and in the effluents from filters operated with septic sewage (E. S. R., 17, p. 300).

The more important conclusions reached are as follows:

"(1) With new sand filters a smaller percentage of the applied nitrogen appears in the effluent than when the filters have been operated for a considerable period.

"(2) With filters producing eminently satisfactory purification . . . the average amount of nitrogen appearing in the effluents as nitrates is but little more than 50 per cent of the nitrogen in the applied sewage.

"(3) This being so, it is clear that, if a filter is not ultimately clogged by stored nitrogenous organic matter, either removal of this matter must be resorted to, together with a removal of some of the filtering material, or a removal by bacterial actions independent of and differing from those of nitrification must be depended upon.

"(4) Much of the increase of unoxidized nitrogen in the effluent of the sand filters has been due to the increase of applied nitrogen year by year and the accumulation of stable organic matter in the filter.

"On account of the application of this larger amount of nitrogen two results ensue: (1) An amount of nitrogen in solution greater than can be easily and completely changed by bacterial action during the period of passage of the sewage through the filter, and (2) an amount of stable organic matter in suspension in the sewage is strained out, and, accumulating in the upper sand of each filter, causes unfavorable conditions, especially in winter, on account of the resultant increased compactness of these upper layers.

"Differing bacterial flora in the filter due to increase in stored organic matter and continued use of the filter may also be an important factor."

The use of copper sulphate at rates varying from 1 part to 1,130,000 parts of water to 1 part to 578,000 parts of water in connection with sand filters resulted in a marked decrease of bacteria in the water and in some cases in the total extermination of *Bacillus coli communis*. Sulphate of alumina used in similar manner produced like though less pronounced germicidal effects.

The bacteria of the air, water, and soil, E. Bodin (*Les bactéries de l'air, de l'eau et du sol. Paris: Masson & Co.; Gauthier-Villars* [*1905*], *pp. 197, figs. 2*).—This book forms one of the volumes of the *Encyclopédie scientifique des aide-mémoire* published under the direction of Léauté, and summarizes the more important facts relating to the bacteriology of the air, water, and soil.

SOILS—FERTILIZERS.

Field operations of the Bureau of Soils, 1904 (sixth report), M. WHITNEY ET AL. (*U. S. Dept. Agr., Field Operations of the Bureau of Soils, 1904, pp. 1159, pl. 1, figs. 45, maps 53*).—This report contains a general review of the work of the Bureau of Soils during 1904 and a discussion of the significance and uses made of the soil surveys, by the Chief of the Bureau, together with detailed accounts of the following surveys:

Soil Survey of Rhode Island, by F. E. Bonsteel and E. P. Carr; Soil Survey of the Vergennes Area, Vermont-New York, by H. J. Wilder and H. L. Belden; Soil Survey of the Auburn Area, New York, by J. E. Lapham and H. H. Bennett; Soil Survey of Adams County, Pennsylvania, by H. J. Wilder and H. L. Belden; Soil Survey of Appomattox County, Virginia, by T. A. Caine and H. H. Bennett; Soil Survey of Lancaster County, South Carolina, by A. S. Root and L. A. Hurst; Soil Survey of the Orangeburg Area, South Carolina, by F. Bennett and A. M. Griffen; Soil Survey of the Charleston Area, South Carolina, by F. E. Bonsteel and E. P. Carr; Soil Survey of Dodge County, Georgia, by C. W. Ely and A. M. Griffen; Soil Survey of the Bainbridge Area, Georgia, by E. O. Fippin and J. A. Drake; Soil Survey of the Gainesville Area, Florida, by T. D. Rice and W. J. Geib; Soil Survey of Macon County, Alabama, by H. J. Wilder and H. H. Bennett; Soil Survey of Sumter County, Alabama, by W. G. Smith and F. N. Meeker; Soil Survey of the Jackson Area, Mississippi, by J. O. Martin and O. L. Ayrs; Soil Survey of the Biloxi Area, Mississippi, by W. E. Hearn and M. E. Carr; Soil Survey of De Soto Parish, Louisiana, by G. B. Jones and La M. Ruhlen; Soil Survey of Anderson County, Texas, by W. T. Carter, jr., and A. E. Kocher; Soil Survey of the Austin Area, Texas, by A. W. Mangum and H. L. Belden; Soil Survey of the San Antonio Area, Texas, by T. A. Caine and W. S. Lyman; Soil Survey of Lawrence County, Tennessee, by C. N. Mooney and O. L. Ayrs; Soil Survey of the Greeneville Area, Tennessee-North Carolina, by C. N. Mooney and O. L. Ayrs; Soil Survey of Warren County, Kentucky, by T. D. Rice and W. J. Geib; Soil Survey of the Wooster Area, Ohio, by T. A. Caine and W. S. Lyman; Soil Survey of Coshocton County, Ohio, by T. D. Rice and W. J. Geib; Soil Survey of the Munising Area, Michigan, by T. D. Rice and W. J. Geib; Soil Survey of the Saginaw Area, Michigan, by W. E. McLendon and M. E. Carr; Soil Survey of the Alma Area, Michigan, by W. E. Hearn and A. M. Griffen; Soil Survey of the Owosso Area, Michigan, by A. W. Mangum and C. J. Mann; Soil Survey of Marshall County, Indiana, by F. Bennett and C. W. Ely; Soil Survey of Scott County, Indiana, by A. W. Mangum and N. P. Neill; Soil Survey of the Boonville Area, Indiana, by A. W. Mangum and N. P. Neill; Soil Survey of the Superior Area, Wisconsin-Minnesota, by T. A. Caine and W. S. Lyman; Soil Survey of Tama County, Iowa, by C. W. Ely, G. N. Coffey, and A. M. Griffen; Soil Survey of Saline County, Missouri, by M. E. Carr and H. L. Belden; Soil Survey of the O'Fallon Area, Missouri-Illinois, by E. O. Fippin and J. A. Drake; Soil Survey of Webster County, Missouri, by J. A. Drake and A. T. Strahorn; Soil Survey of the Kearney Area, Nebraska, by J. O. Martin and A. T. Sweet; Soil Survey of Allen County, Kansas, by J. A. Drake and W. E. Tharp; Soil Survey of the Garden City Area, Kansas, by J. L. Burgess and G. N. Coffey; Soil Survey of the Cando Area, North Dakota, by E. O. Fippin and J. L. Burgess; Soil Survey of the Greeley Area, Colorado, by J. G. Holmes and N. P. Neill; Soil Survey of the Bear River Area, Utah, by C. A. Jensen and A. T. Strahorn; Soil Survey of the Yuma Area, Arizona-California, by J. G. Holmes et al.; Soil Survey of the Sacramento Area, California, by M. H. Lapham, A. S. Root, and W. W. Mackie; Soil Survey of the Bakersfield Area, California, by M. H. Lapham and C. A. Jensen; Soil Survey of the San Bernardino Valley, California, by J. G. Holmes et al.

During the calendar year 1904, 28,444 square miles, or 18,204,160 acres, were surveyed and mapped on a scale of 1 in. to the mile. Prior to that year the total area surveyed and mapped was 60,411 square miles, or 38,663,040 acres. The average cost of the work in 1904 was $2.43 per square mile. The total area surveyed and mapped up to July 1, 1905, was 99,408 square miles, or 63,621,120 acres, distributed among 43 States and Territories.

It is stated that "the surveys have been so distributed that nearly every prominent agricultural interest has been touched, and the soils of some part of every important agricultural region have been studied. Aside from the specific problems which affect individual areas, there have been developed a number of vital problems which concern wide extents of agricultural land," such as the classes of soils especially adapted to sugar beets, tobacco, early vegetables and fruits, corn, grapes, rice, apples, small grains, grasses, etc., and the reclamation of alkali lands.

"About 400 different types of soil have been encountered by the Soil Survey since the beginning of its field work in 1899. These soil types have been studied and classified with a view to ascertaining the particular crops which each type is best suited to produce. They have also been studied from the double standpoint of meeting the local needs and of placing the particular type not only in its true relationships to the area in which it occurs, but also in its proper place in the general classification of the soils of the United States. Holding these two objects in view, the study of the soils through the field work is coming to have two primary objects. The first of these, the discovery of the best crops for each soil, is known as crop adaptation. The second, or the study of the method by which each soil may be induced to grow the largest economical crop, is known as the soil fertility or the soil management problem. In addition, various local problems are encountered in nearly every area."

It is explained that the classification of soils used in this work is based mainly on texture, structure, organic matter content, and physiographic relationships. "In the classification employed by the Bureau of Soils the aim is to secure a simple, general system, which shall express those facts with regard to soils which are easily recognizable by a person possessing ordinary powers of observation and no unusual knowledge either of classifications or of soils. For this purpose the common names of soils used by the general agricultural public are adopted and defined for use in the Soil Survey reports. Owing to the fact that in different localities soils of the same texture will receive slightly different names, it has been found necessary to define rather carefully what is meant by a clay, a loam, or a sand. Thus, in regions where the heavy clay or clay loam soils predominate a somewhat sandy soil is very often considered to be a real sand, while if it were compared with the soils of a sandy locality it would be considered and would be spoken of as a rather heavy loam.

"Through the use of its standard method of mechanical analysis, which determines the amounts of the different-sized particles found in a soil, the Bureau aims to eliminate these local differences in soil naming, in order that a uniform standard, such as may be used both for scientific and practical purposes, may become common throughout the regions where surveys are made. The naming of the soils is not intended to introduce confusion, but rather to avoid the use of local designations which may mean one thing in one place and another thing in a different place."

It is stated that "in order that the vast amount of valuable information which has been secured by the experiment stations may be made of the most direct application to each farming community within the State served, it is necessary for the farmer to know not only the details of any particular experiment, but also for him to be able to judge whether his own farm contains the types of soil upon which the experiment has been carried on, and whether it lies within the same general climatic belt as the experiment station itself. If he can be assured of these two facts, it is then possible for him to derive the greatest benefit from the results of any particular experi-

ment. If he can not be assured of these facts, it remains for him to discover whether the conditions under which he is working are the same as those which are found at the experiment station.

"The Soil Survey is thus seen to serve not only a local purpose of this kind, but through its general classification of the soils of extensive regions it has frequently occurred that the results secured at a given experiment station become applicable not only within the limits of that State, but are also found to be applicable in other adjoining States, or throughout a considerable region. It thus renders the results of experiments conducted at the various experiment stations applicable throughout a wide range of territory not restricted by State lines."

The recent work of the American Soil Bureau, E. J. RUSSELL (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 327-346, pl. 1, figs. 2*).—The more technical work of the Bureau of Soils of this Department, especially as related to soil fertility, soil physics studies, and alkali soils is critically reviewed and some of the practical applications of the results are pointed out.

Soil investigation and applied soil investigation or technology of soils, E. RAMANN (*Jour. Landw., 53 (1905), No. 4, pp. 371-374*).—The author argues in favor of the drawing of a clear distinction between soil investigations as an independent subject of scientific inquiry, and the technology of soils, which deals with the application of the results of soil investigations to agriculture.

The mineral constituents of the soil solution, F. K. CAMERON and J. M. BELL (*U. S. Dept. Agr., Bur. Soils Bul. 30, pp. 70, figs. 4*).—The nature and purpose of this bulletin is concisely stated by the authors as follows:

"In order to establish the views and premises that are fundamental for certain researches which the Bureau has been and is now conducting, it has been deemed advisable to bring together the more important data which the publications of other investigators furnish, together with some further experimental results obtained in the laboratories of the Bureau. The literature bearing on this subject is now very voluminous, confusing, and contradictory. It has not been deemed advisable to undertake a complete bibliography, but it is believed that sufficiently numerous citations have been made to give an accurate idea of the present status of the subject, as well as to demonstrate the points which it is sought to establish in the text."

The bulletin reviews the literature and discusses the general characteristics of soil; the minerals found in soils and their solubility and hydrolysis; solubility of the minerals as affected by temperature, pressure, carbon dioxid, inorganic acids, organic compounds, and vital agencies; absorption of gases and of solutions (by soil, sand, paper, carbon, silica, kaolin, etc.); chemical reactions at surfaces; and flocculation.

Studies of the properties of and the phenomena presented by the soil solution are considered of fundamental importance, because previous studies of the Bureau have led to the conclusion that "the growing plant obtains its mineral nutrients directly from the aqueous solution formed by the soil moisture."

The principal points which it is sought to establish in this bulletin are that as a rule "(1) the soil contains all the common rock-forming minerals. There may be, indeed probably are, extreme cases for which this statement would not be strictly accurate, but it may be regarded as a rule holding quite rigidly for practically all arable soils. It has also been shown that the weight of available evidence justifies the further generalization that—

"(2) Some, at least, of each mineral species in the soil is presenting surfaces of the mineral as such to the solvent action of the soil water. This being the case it follows that—

"(3) The minerals of the soil will continue to dissolve. On dissolving the minerals carrying the stronger basic or acidic constituents will be more or less completely hydrolized, and generally the stronger hydrolization product will remain in solution and the weaker one will be more or less completely precipitated. It is thus that the

principal mineral plant-food constituents are brought into solution and made available to the plant. What concentration the soil moisture actually possesses has been determined with what may be regarded as approximate accuracy. Two methods have been devised for extracting the free solution actually existing in a soil, and analyses of a number of such extracts obtained from several types of soil of widely different origin and composition have yielded an average for potassium (K) of 27.3 parts and for phosphoric acid (PO_4) 8.5 parts per million of solution.

"The approximate uniformity of the individual results make it appear improbable that further accumulation of data would change these average figures materially. . . . Since practically all soils contain the same minerals and essentially the same processes are taking place in all of them it would follow that about the same solution should be expected in all soils, except in so far as changes were introduced by differences in absorptive powers of the solids, rates of movement of water, etc. Examinations of a large number of soils, many of which have been already published, established empirically that these considerations are justified. . . .

"(4) The concentration of the soil solution, with respect to the principal mineral plant-food nutrients, is sufficient for the growth and development of crops. And, further, the magnitude of the concentrations is the same for practically all soils."

A review of studies of the effect of surfaces in modifying not only in intensity but even in kind the reactions taking place in solutions in contact with them and of the nature and effect of the organic matter of the soil leads to the general conclusion that "the development of a modern soil chemistry is dependent upon a study of the chemical changes induced by surface contact, and upon a study of the proportions of the water soluble organic as well as inorganic matter of the soil."

A comparison of the results obtained by the method of cultures in paraffined wire pots with field results on the same soil, H. J. WHEELER, B. E. BROWN, and J. C. HOGENSON (*Rhode Island Sta. Bul. 109, pp. 13–44, pls. 5*).—This is an account of a series of experiments made in cooperation with the Bureau of Soils of this Department to test the value of the paraffined wire pot method of testing the fertility of soils devised by the Bureau (E. S. R., 16, p. 650; 17, p. 227). Seventeen series of experiments with soils from plats which have been under experiment at the station for several years past and from a farm on the Kingston Plain are reported. These include tests of various combinations of fertilizers, barnyard manure, green manure, lime, etc., on corn, wheat, crimson clover, alfalfa, and lettuce, the effect of continuous planting on the same pots with and without renewal of the manures, fertilizers, etc., being studied.

The results are thus summarized:

"Tests by the method of paraffined wire pots of a soil which, under the existing field conditions was so poor as to produce Indian corn only 5½ in. high during the entire season, revealed manurial requirements in accord with those shown by plant tests in another part of the same field. This was true both before and after liming. Marked benefits from liming and from the use of stable manures, similar to those observed in the field, were also obtained.

"It was shown by this method that 'denitrification,' or a destruction of nitrates, very likely resulted where the stable manure and nitrates were used together. There is no evidence to show that this denitrification was necessarily any more pronounced than it would have been in ordinary pots.

"The use of all three mineral manures, in addition to lime, also depressed the yield. This effect was apparently lessened by the presence of horse manure. Upon the third replanting this ill effect disappeared. It seems probable that upon a similar soil, if limed, the quantities of the manurial substances should be reduced in making such tests.

"Benefit from adding green manures was shown in the pots, as is also the case in the field.

"Tests of like amounts of coarse and fine horse manure show, by the pot method, poorer results with the fine material. This was probably due to the fact that the finer manure was more intimately mixed with the soil, thus causing a more even distribution of material which could furnish food for the organisms which destroy nitrates. Occasional aeration seemed in this case to have been beneficial, but in another instance it failed to lessen the apparent destruction of nitrates.

"The benefit, shown by the method of paraffined pots as a result of introducing hay, straw, and green parts of plants into the soil, was striking. The materials are arranged below in the order of the benefit observed when used with lime, the most beneficial being at the top: Cowpea vines, Indian corn plants, rye straw, clover plants, sumac stems and leaves, timothy hay.

"In a trial of different phosphates for purposes of comparison with field results, the data obtained with the paraffined pots point in most particulars in the same direction as those obtained in the field. The effect of lime in increasing the efficiency of roasted 'Redondite' (iron and aluminum phosphate), as shown by the pots, was also in agreement with field trials.

"Comparisons of both the after effect and the immediate effect of sodium and potassium salts, though showing agreement with field results in the main essentials; differed considerably. This was doubtless due in part to unequal drying out of the soil in the first instance, before the tests were made, and to the fact that the variety of plant was not the same that was used in the field.

"Pot tests of the soil where nitrates had been used for grass in different amounts gave results essentially as were to be expected from the field experiments.

"The effect of fresh horse manure in depressing the yield and transpiration is in accord with other observations, and it may have been due to a destruction of nitrates. A similar effect of dried horse manure was also observed.

"The influence of liming both in connection with nitrate of soda and suphate of ammonia was shown by the pot tests with several varieties of plants, to be in good agreement with field tests.

"A test of an unproductive soil at West Kingston, which was of similar origin to that upon the experiment station farm, revealed the same requirements both before and after liming as the station soil. Liming was also helpful.

"In general, the tests by the method of the paraffined wire pots show good agreement with field observations of a whole season's duration."

Unproductive soils, T. Biéler-Chatelan (*Chron. Agr. Vaud, 18 (1905), Nos. 22, pp. 531–535; 23, pp. 558–562*).—This article discusses soils rendered unproductive by defective drainage and bad physical condition due especially to improper and exhaustive methods of culture, and describes various methods of improving such soils.

Some changes in the soil under the influence of the activity of earthworms, A. Murinov (*Mater. Izuchen. Russ. Pochv., 1905, No. 16; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 4, pp. 460, 461*).—Alternate layers of different kinds of soil were placed in zinc boxes with one glass side, earthworms were added, the soil kept in a proper state of moisture, and the changes which the soil underwent determined by analyses at the beginning and end of the experiments, which lasted one year. A check series of boxes was treated in the same manner except that earthworms were not added.

The results show that in the soils to which the earthworms were added the phosphoric acid soluble in 10 per cent hydrochloric acid increased in all cases. The lime content, which at the beginning was greatest in the surface soils, was found at the end of the experiments to gradually increase from the surface toward the subsoil. The nitrogen was more uniformly distributed throughout the soil at the end of the experiment than at the beginning.—P. FIREMAN.

The influence of a constant weak electric current on the solubility of the nitrogen and the phosphoric acid of the soil, M. YEGOROV (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 3, pp. 315–324*).—Experiments are reported in which a 100 voltage current varying from 0.002 to 0.23 ampere in different cases was passed through chernozem and clay soils contained in glass boxes and the effect on the solubility of the soil constituents was observed.

It was found that by this treatment the phosphoric acid soluble in citric acid was increased almost 100 per cent. The nitrate nitrogen was decreased in about the same proportion. The ammonia nitrogen, however, was increased 3 to 5 times, so that there was a considerable average increase in total soluble nitrogen, this increase evidently taking place at the expense of the insoluble organic compounds.—P. FIREMAN.

Hygroscopicity, heat evolved on moistening (Benetzungswärme), and mechanical analysis of soils, A. MITSCHERLICH (*Fühling's Landw. Ztg., 54 (1905), No. 20, pp. 673–675*).—The information contained in this article is condensed from the author's Treatise on Soils for Farmers and Foresters, published by Paul Parey, Berlin, 1905. The terms used are defined, and their relations to each other and to plant growth are briefly discussed.

It is stated that hygroscopic moisture and the heat evolved on moistening soils are of no importance from the standpoint of plant growth. Wollny's classification of soil particles is given and the comparative value of mechanical analysis, hygroscopicity and heat evolved on moistening as means of judging of the character of soils is discussed The author is of the opinion that mechanical analysis may be replaced for this purpose with advantage by the determination of the heat evolved on moistening, or preferably by determination of hygroscopicity.

The soil and the subsoil of the Veliko-Anadolsk forest as one of the causes of the decay of forest plantations, N. N. STEPANOV (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 3, pp. 257–299*).—The investigations here reported were made on an artificial forest plantation in the steppes region of southern Russia on lands which were formerly treeless and which have soils rich in soluble constituents (alkali). Studies of the soil and subsoil were made in places where trees were growing vigorously and in places where the trees had failed to grow.

The results show quite clearly that the failure of the trees to grow was due to excess of soluble salts (especially sodium carbonate) in the upper layers of the soil. The formation of calcareous hardpan in the subsoil had also in some cases brought about conditions unfavorable to tree growth. The lack of uniformity in tree growth on these soils is said to be due to irregularity in concentration of the soluble salts in the surface soil, varying with the topography of the land and the character of the season. The occurrence of gypsum in the soils at short distances from the surface indicates that they have not been sufficiently leached for the successful growth of trees, although gypsum itself is not an injurious salt and tends to improve the mechanical and moisture conditions of the soil.

In conclusion the author urges the importance of carefully examining such soils before forest planting is attempted, as well as the use of seeds produced on the soils of species which are known to be resistant to alkali.—P. FIREMAN.

Does the northern forest dry the soil? D. M. KRAVCHINSKI (*Lyesoprom. Vyestnik, 1905, No. 1; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 4, p. 511*).—Comparative determinations of moisture in forest soil and in adjoining pasture soil are reported, which show that the forest soil was but slightly drier than the pasture soil.—P. FIREMAN.

On the origin of moors, C. A. WEBER (*Ztschr. Angew. Chem., 18 (1905), No. 42, pp. 1649–1654*).—A discussion of the geological and botanical factors involved in the formation of upland and lowland moors, with descriptions of the characteristics of some typical North German moors.

Calcium carbonate in some soils of Valpantena (Verona), R. DE POLO (*Staz. Sper. Agr. Ital., 38 (1905), Nos. 7–8, pp. 622–628*).

Contribution to the question of volatilization of ammonium salts in soils, H. WANGNICK (*Fühling's Landw. Ztg., 53 (1904), No. 18, pp. 695–699; abs. in Centbl. Agr. Chem., 34 (1905), No. 10, p. 714*).—Experiments on loam and sandy soils containing different amounts of calcium carbonate show the loss of considerable amounts of ammonia, varying with the proportion of lime, when ammonium salts are added to such soils. The losses observed, however, were smaller (not over 20 per cent in any case) than those reported by Wagner as having been obtained by Hals (E. S. R., 15, p. 234).

Soils and fertilizers, H. SNYDER (*Easton, Pa.: The Chemical Pub. Co., 1905, 2. ed., pp. X + 294, pl. 1, figs. 40*).—This is a second edition of this work, the first being published in 1899 under the title The Chemistry of Soils and Fertilizers (E. S. R., 11, p. 418).

"In the revision of the text the subject-matter has been entirely rewritten, new material has been added, and the laboratory practice has been made a more prominent feature. These additions have changed the scope of the book to such an extent as to necessitate a change of name. The work as now presented includes all of the topics and laboratory practice relating to soils as outlined by the committee on methods of teaching agriculture, appointed by the Association of Agricultural Colleges and Experiment Stations."

The book gives in condensed form the principles underlying the conservation of soil fertility and the economic use of manures. A bibliography of 95 references is appended.

Fertilizer inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 120, pp. 153–168*).—This bulletin contains the analyses of 253 samples collected by the station of the brands of fertilizers licensed in 1905.

The results of inspection show that as competition becomes closer and the processes of manufacture somewhat more trustworthy the fertilizers tend to more closely approach the minimum guaranty, and it rarely happens at present that fertilizers carry much above the minimum guaranteed percentages of nitrogen and potash, the more costly constituents of a fertilizer. In fact the results in 1905 show that over 80 per cent of the samples collected were below the guaranty in at least one constituent.

Analyses of commercial fertilizers, M. B. HARDIN (*South Carolina Sta. Bul. 115, pp. 30*).—This bulletin contains analyses of 522 samples of fertilizers collected during the season of 1904–5. "These analyses were published in 15 weekly bulletins issued and distributed during the months of February, March, April, and May." Eighty-four samples of cotton-seed meal, previously reported in Bulletin 105 of the station, are also included, and notes on valuation and explanations of terms used in fertilizer analyses are given.

Commercial fertilizers, H. J. WHEELER ET AL. (*Rhode Island Sta. Bul. 110, pp. 47–60*).—"This bulletin is supplementary to Bulletin No. 108, and the two contain the analyses of such commercial fertilizers as have been found on sale in Rhode Island during the year 1905."

The utilization of atmospheric nitrogen, O. N. WITT (*Chem. Ztg., 29 (1905), No. 98, pp. 1261–1264; abs. in Mark Lane Express, 93 (1905), No. 3873, Fert. and Feed., p. III*).—This article reviews the various attempts which have been made from the time of Cavendish to prepare nitrogen compounds from the free nitrogen of the air, including the more recent attempts of Bradley and Lovejoy of the Atmospheric Products Company, of Niagara Falls, and Frank's calcium cyanamid (lime nitrogen) process.

It is claimed that the former has proved too costly to be a commercial success. The commercial success of the latter depends upon the possibility of securing cheaper

methods of producing electrical energy and of freeing the nitrogen of the air from its associated constituents. The most promising results with the Frank process from a commercial standpoint have apparently been obtained in Italy, where cheap and abundant water power has been utilized in the generation of electrical energy.

The most successful electrical method which has yet been suggested, judging by the results reported, is that of K. Birkeland and S. Eyde, of Christiania, Norway. The inventors of this process, for which patents have been taken out in this country as well as in Europe, claim that it has not been possible up to the time of their discoveries to utilize electric energy in a single powerful arc for the production of nitric compounds from the atmosphere in an economical manner.

As stated in the United States patents, their invention is based upon the fact that electrical discharges between electrodes placed within a magnetic field may be dispersed by the action of the magnets, and that "an electric arc of high or low tension may be dilated or spread into a large permanent flame having the shape of a sheet or a disk of a volume several hundred times as large as a regular or primary arc of the same energy when the electrodes are placed in a suitable manner in a powerful magnetic field—for instance, between the poles of a magnet and transverse to the flux of said field."

In this way it is possible "to transform a great part of the electrical energy into heat capable of being absorbed by certain gases, as chemical energy under conditions which are attended by valuable chemical reactions. This is due to the fact that the efficiency of a flame in endothermic chemical processes is a function of the ratio between the volume and the temperature of the flame. [It is claimed that by this process it is possible] to have furnaces at continuous work with several hundred kilowatts at each flame, the heat being economically utilized, a result which was not heretofore possible unless the energy employed for each arc was only very small."

It is reported that in works which have been built at Notodden, Norway, to utilize water power from large falls in that vacinity 1,500 kg. per day of water-free nitric acid are now being made. The final product is in form of calcium nitrate, the fertilizing value of which is being studied by a number of investigators (E. S. R., 17, p. 449).

Nitric acid and nitrates from the nitrogen of the air (*Ztschr. Angew. Chem., 19 (1906), No. 1, pp. 37, 38*).—This article deals with the Birkeland and Eyde process for the preparation of nitrogen compounds from the nitrogen of the air, and describes particularly the progress that has been made in utilizing for this purpose the abundant power furnished by waterfalls in southern Norway.

It reports that the success of small experimental works has been such that a number of larger plants are now being established at various places. The general principles upon which better methods of utilizing electric power have been based in this process are stated in the preceding abstract. It is stated that in this method the gases after treatment contain from 1 to 2 per cent of nitric oxid, which is absorbed partly in water and partly in milk of lime.

The solution thus obtained is concentrated and saturated with limestone and finally obtained either as crystallized calcium nitrate or by addition of an excess of lime according to Collett's process, in form of a basic fertilizer known commercially as "basic lime niter." The latter contains from 8 to 9 per cent of nitric nitrogen and about 22 per cent of lime as hydroxid and carbonate. This material has given very good results as a fertilizer in the experiments which have been made with it.

Calcium nitrate manufacture in Norway (*Engin. and Min. Jour., 81 (1906), No. 4, p. 192*).—A brief note on an experimental factory at Notodden, employing the Birkeland and Eyde process, referred to above, which has been in operation since the beginning of 1905, and on the construction of large additional works at Svälgfos, near Skien, where 30,000 horsepower will be available.

The new Norwegian industry of manufacture of "lime niter" (*Ugeskr. Landm., 51 (1905), No. 50, pp. 569, 570*).—The paper describes the method of Birkeland and Eyde for the oxidation of atmospheric nitrogen by electricity and the manufacture of calcium nitrate therefrom. The company which has been organized for the manufacture of this fertilizer will utilize the power of three Norwegian waterfalls to the extent of over 30,000 horsepower.—F. W. WOLL.

Nitrate of calcium factory for Norway, H. BORDEWICH (*Mo. Consular and Trade Rpts.* [*U. S.*], *1906, No. 304, pp. 245, 246*).—A brief account of recent progress in the establishment of factories for the manufacture of calcium nitrate by the Birkeland and Eyde process.

Utilization of the nitrogen of the air (*Chem. Ztschr., 5 (1906), No. 2, pp. 38–40*).—This is a note on a discussion by O. N. Witt of the Birkeland and Eyde method (see above).

The principle upon which the method is based is briefly explained and some of the practical results already obtained in Norway are given. It is stated that an experimental plant, which has been in operation for a year or more, has utilized water power in the production of electrical energy at a cost of 12 marks (about $3) per horsepower yearly. It has produced from 500 to 600 kg. (1,100 to 1,320 lbs.) of water-free nitric acid per kilowatt year. The daily output has been 1,500 kg. (3,300 lbs.) of water-free nitric acid.

The production of nitric acid from the air, M. BODENSTEIN (*Ztschr. Angew. Chem., 19 (1906), No. 1, pp. 14–21*).—A review of recent progress in development of commercial processes of manufacturing nitrogen compounds from the air.

Nitric acid from atmospheric nitrogen, F. WINTELER (*Chem. Ztg., 29 (1905), No. 99, pp. 1278, 1279*).—This is a review of J. Brode's book on the oxidation of nitrogen in the high-tension flame, which gives a bibliography of the subject beginning with the work of Cavendish and Achard in 1784, Priestley in 1788, and L. Odier published in 1798, who observed the oxidation of the nitrogen of the air at high temperature or by means of electrical discharges.

The utilization of the nitrogen of the air, A. NEUBURGER (*Ztschr. Angew. Chem., 18 (1905), Nos. 45, pp. 1761–1766; 46, pp. 1810–1814; 47, pp. 1843–1852*).—This article deals with 4 methods of utilizing the nitrogen of the air as follows: (1) Preparation of nitrids, (2) production of ammonia and ammonium compounds, (3) formation of cyan compounds and their derivatives, and (4) the production of oxids of nitrogen, nitrous and nitric acids.

As a result of his review the author concludes that recent progress in the development of methods of utilizing the nitrogen of the air has been such that we can view without alarm the exhaustion of the Chilean deposits of nitrates. The large amount of energy, especially electrical energy, required is the greatest present drawback to the commercial success of processes of making nitrates from the nitrogen of the air, but great progress has been made in this respect in recent years and there is reason to expect that still greater progress will be made along this line in the near future.

On the utilization of the nitrogen of the air for agricultural purposes with special reference to lime nitrogen and its fertilizing value, H. IMMENDORFF and O. THIELEBEIN (*Fühling's Landw. Ztg., 54 (1905), No. 23, pp. 787–795*).—The authors report pot experiments with oats and mustard, which gave results confirming in general the conclusions of Frank (E. S. R., 16, p. 759) regarding the fertilizing value of lime nitrogen on different kinds of soils and the best methods of using this material as a fertilizer, i. e., it is not suited to acid humus soils or light sandy soil of acid reaction; it gives good results when applied 8 to 14 days before seeding at rates of 150 to 300 kg., equal to 30 to 50 kg. of nitrogen, per hectare, and immediately worked in, on soil well supplied with lime and regularly manured with barnyard manure; and it is in no case to be used as a top-dressing.

The fixation of nitrogen and electrochemistry, P. A. GUYE (*Rev. Gén. Sci., 17 (1906), No. 1, pp. 28–34*).—This article reviews the various methods which have been proposed for the fixation of nitrogen by electrical means, including the lime nitrogen method of Frank and the direct electrical methods, such as those of Bradley and Lovejoy, Muthmann and Hofer, Nernst, von Lepel, and Birkeland and Eyde. A study is given of the phenomena of the electric arc in air and of the conditions which affect its efficiency, especially the question of temperature.

Agriculture and the nitrogen supply, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 6, pp. 165, 166*).—The importance of nitrogen in plant production, the sources of supply of this element, and the possibility of drawing on the air for future supplies are briefly discussed.

The nitrogen balance of soils (*Deut. Land v. Presse, 32 (1905), No. 97, p. 807*).—The possibility of maintaining the nitrogen balance in soils exhausted by heavy cropping by drawing on the nitrogen supply of the air is briefly discussed.

Note on the fate of calcium cyanamid in the soil, S. F. ASHBY (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 358–360*).—The experiments here reported were similar to those reported by F. Löhnis (E. S. R., 17, p. 345), in which it was shown that soil bacteria, especially *Bacterium kirchneri* and *B. lipsiense*, are active agents in rendering calcium cyanamid assimilable for crops and that the reaction is not a purely chemical one as has been generally supposed.

The author's experiments were made in nutrient solutions, some of which were inoculated with extract from a fertile soil, others partly sterilized, and still others treated with corrosive sublimate. In the inoculated soils as much as 80 per cent of the cyanamid nitrogen was converted into ammonia; in those which were partly sterilized very small amounts of ammonia were formed; and in those treated with corrosive sublimate practically none was formed.

The conclusion is therefore drawn "that the formation of ammonia from cyanamid in the soil can be due in only a very minor degree to a purely chemical process." The lime nitrogen used in these experiments contained 20.3 per cent nitrogen, equal to 58 per cent of pure calcium cyanamid. "By precipitating all the lime with ammonium oxalate, evaporating the filtrate to dryness, extracting with a little strong alcohol and allowing the latter to evaporate at the ordinary temperature, to obtain yellow crystalline plates which yielded on analysis 62.70 per cent nitrogen and agreed with the description given for dicyandiamid (Beilstein, *Organische Chemie*) which contains when quite pure 66.60 per cent nitrogen. A solution of calcium cyanamid after long standing goes over into dicyandiamid which yields no ammonia by distillation with magnesia."

Calcium cyanamid (lime nitrogen), L. GRANDEAU (*Jour. Agr. Prat., n. ser., 10 (1905), No. 52, pp. 808, 809*).—A brief general account of the preparation, properties, and use of this material as a fertilizer.

Experiments with lime nitrogen (*Deut. Landw. Presse, 32 (1905), No. 92, pp. 770, 771*).—The process of preparing this substance is briefly described, the changes which it undergoes in the soil (including those due to the action of micro-organisms) are explained, and plat experiments with oats are reported.

When applied immediately before seeding, germination and growth were seriously interfered with; if applied 1 week before seeding, growth was normal. The period of growth was shortened and the protein content increased with increase of length of time the lime nitrogen was applied before seeding up to 5 weeks.

Experiments with lime nitrogen, VON SEELHORST and A. MÜTHER (*Jour. Landw., 53 (1905), No. 4, pp. 329–356; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 519, II, p. 46*).—A series of pot experiments with oats on sand, loamy sand, and loam soils to determine the best time and manner of applying this material as a fertilizer is reported. The results show that the lime nitrogen gives good results on all

moderately fine-grained soils when carefully incorporated with the soil about 8 days before the planting of the crop.

Comparative tests of the fertilizing value of nitrate of soda, sulphate of ammonia, and calcium cyanamid (lime nitrogen), L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 1, pp. 8–10*).—The results of plat experiments carried out during 1904 and 1905 with these 3 substances as fertilizers for potatoes and barley are briefly reported.

The three fertilizers were used in amounts furnishing 45 kg. of nitrogen per hectare (40.08 lbs. per acre) in connection with a basal fertilizer supplying phosphoric acid and potash. In the experiments with potatoes in 1904 the relative effectiveness of the 3 fertilizers was nitrate 100, sulphate 96.5, lime nitrogen 93.4; in 1905 the relative effectiveness was nitrate 100, lime nitrogen 101.83, sulphate 95.36.

In experiments with barley in 1905 the lime nitrogen gave results somewhat better than those obtained with sulphate of ammonia, both being considerably inferior to nitrate of soda.

In connection with these experiments observations were also made upon the influence of other fertilizers supplying phosphoric acid and potash on the effectiveness of nitrate of soda. It was shown that the absence of fertilizers supplying phosphoric acid and potash greatly reduced the efficiency of the nitrate of soda. It was also shown that the nitrate of soda was almost entirely lost if its application was delayed until after the heading of cereals.

Contribution to the knowledge of the life conditions of nitrogen-collecting bacteria, H. FISCHER (*Jour. Landw., 53 (1905), No. 3, pp. 289–297*).—A continuation of previous experiments (E. S. R., 17, p. 120) is reported, showing that the activity of the organisms which fix nitrogen in the soil is greatly influenced by the character of the latter, particularly its lime content and physical condition, and suggesting that it may be possible to so modify these conditions in practice as to promote the activity of the desirable organisms and retard the development of the undesirable.

Inoculation of legumes, K. F. KELLERMAN and T. R. ROBINSON (*U. S. Dept. Agr., Farmers' Bul. 240, pp. 7*).—In this bulletin special attention is called to an improved method of distributing pure cultures of root-tubercle bacteria in nitrogen-free nutrient solution in hermetically sealed tubes, and detailed directions are given for using these cultures.

AGRICULTURAL BOTANY.

Experiments with plants, W. J. V. OSTERHOUT (*New York: The Macmillan Co., 1905, pp. XIX + 492, figs. 253*).—This book, which is one of the recent contributions to modern methods of investigation, is based upon the idea that principles involved in experiments are of prime importance, and the work is so arranged that whether used by the teacher or pupil it brings out the underlying principles of biology rather than quantitative results.

While applicable for use in the higher schools and colleges, yet it is so written and the choice of material and apparatus so simplified that it could be used in secondary schools. The author has shown how to make use of the most commonplace materials as apparatus for the demonstration of experiments showing the properties and functions of plant organs. Chapters are devoted to the various phenomena of plant life, and the work concludes with a discussion of plant breeding and the principles underlying it.

The proteases of plants, III, S. H. VINES (*Ann. Bot., 19 (1905), No. 74, pp. 171–187*).—In previous papers the author has shown the wide distribution of proteases in plants, some of which act upon the fibrin or albumin, while others attack simpler forms of proteids, as albumoses and peptones, affecting their proteolysis. To this last class of enzyms the name ereptase or erepsin is given.

Erepsin is found more widely distributed in plants than the fibrin-digesting proteases. In another publication (E. S. R., 17, p. 542) the author concluded from his studies of papain that it contained both erepsin and a fibrin-digesting enzym similar to pepsin. In the present paper the author reports having found by the same methods of study these two proteases in the juice of the pineapple, in yeast, mushrooms, malt, hyacinth bulbs, and in the liquor found in the pitchers of Nepenthes.

In summarizing the results of the investigations the author says that peptolysis appears to take place within a range extending from distinct alkalinity to a degree of acidity quite beyond that occurring in nature. On the other hand, fibrin-digestion is much less uniform, showing wide and striking differences, yeast, mushroom, malt, and Nepenthes being limited to acid reactions, while fibrin-digestion took place in alkaline reactions with papain, pineapple, and hyacinth bulbs.

All the plants examined contained ereptase. In some of these it was found to be associated with a greater or less proportion of a peptase, but in no plant was a peptase found to exist unassociated with ereptase.

The nitrogen nutrition of chlorophyll-bearing plants, O. Treboux (*Ber. Deut. Bot. Gesell., 22 (1904), No. 10, pp. 570–572; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 510, II, p. 276*).—A preliminary report is made of investigations on the availability of various forms of nitrogen for plants. The studies included nearly all groups of chlorophyll-bearing plants and comparisons were made with some fungi.

The summary account given shows that nitrogen as nitrites is generally available when in alkaline solutions, but poisonous in acid solutions. The poisonous action depends upon the degree of concentration of the solutions, and for the nitrites it is a little lower than for the ammonium salts. In comparing nitrates and nitrites it was found that they possessed practically the same efficiency, although in a few instances nitrates proved of greater nutritive value than nitrites. Ammonium salts were found to be still more available than either nitrates or nitrites.

In comparing the organic compounds, amins and amids were studied, and for the lower groups of plants they were found to be about equally valuable. For the higher chlorophyll-bearing plants the amids are said to be less assimilable. The ammonium salts of corresponding organic acids are more assimilable than the amin acids. The author believes that asparagin and similar compounds are split up by enzyms and the ammonia liberated, and further that they are not directly used by the plant in forming proteids. It is claimed that ammonium salts are most suited to the nitrogen nutrition of chlorophyll-bearing plants, and that the intervention of nitrite and nitrate bacteria is not always necessary.

Studies of endotrophic mycorrhiza, I. Galland (*Rev. Gén. Bot., 17 (1905), Nos. 193, pp. 5–48; 194, pp. 66–85; 195, pp. 123–136; 197, pp. 223–239; 199, pp. 313–325; 202, pp. 423–433; 203, pp. 479–500, pls. 4, figs. 6*).—The author has made anatomical and biological studies of many forms of endophytic growth, some of which are but little known. His investigations have shown the possibility of grouping the mycorrhiza into 4 series.

In the first series, which is represented by *Arum maculatum*, the mycelium after penetrating the cortex of the root develops among the cells, terminating in haustoria, which limit further growth. In the second series the mycelium penetrates the cells and the haustoria are developed latterly, their growth being indefinite. This type is represented by *Paris quadrifolia*. In the third series, typified by the Hepaticæ, the mycelium spreads over the soil and lower surface of the thallus. It enters the host through the rhizoids and develops within the plant cells, where the haustoria are transferred into spongioles. The growth of the mycelium is indeterminate. The fourth series is found among the orchids, where the mycelium is always intracellular and indefinite in growth and assumes a closely knotted development.

Aside from these distinguishing characters, all kinds of mycorrhiza show a uniformity of constitution and cytological structure of the mycelium, and the presence

of certain special organs which are concerned either with the temporary storage of reserve material or as absorptive organs. The author holds that mycorrhiza exist as sort of internal saprophytes, taking through their haustoria some of the elaborated material in the cortical cells of the host plant, and in turn the host plant makes use of the mycorrhiza through the digestion and absorption of the haustoria and other organs. Instead of a harmonious symbiosis, the author claims that the relationship is one of feeble antagonism between the fungus and its host. A bibliography of literature is included.

Heliotropism indirectly caused by radium, H. MOLISCH (*Ber. Deut. Bot. Gesell., 23 (1905), No. 1, pp. 2–8, fig. 1; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 512, II, p. 412*).—Experiments with radium preparations alone failed to show any heliotropic motion in seedlings of vetch, lentil, and sunflower, or in *Phycomyces nitens*, but when mixed with zinc blende a very active movement was induced. The effect is attributed not to the emanations from radium, but to the phosphorescence induced in the zinc blende. Laboratory experiments were highly successful, but in a forcing house the experiments failed, owing, it is thought, to the presence of traces of illuminating gas and other impurities in the air.

Hemicellulose as a reserve material in forest trees, H. C. SCHELLENBERG (*Ber. Deut. Bot. Gesell., 23 (1905), No. 1, pp. 36–45*).—A summary is given of the observations of the author and others on the occurrence of hemicellulose as a reserve material in forest trees. This form of cellulose is said to be deposited toward the end of the growing season, and may be used by the tree any time before becoming lignified.

Wild medicinal plants of the United States, ALICE HENKEL (*U. S. Dept. Agr., Bur. Plant Indus. Bul 89, pp. 76*).—A compiled list is given of the drug plants of this country, using as a basis the catalogues of dealers in crude drugs and the standard works on systematic botany.

Only such wild medicinal plants as have commercial value are considered. Both official and nonofficial drugs are included in the list, the information being given under the accepted botanical name of the plant. Brief notes are given indicating the more important features of habit, growth, distribution, parts of the plant used, and the official status of the product, etc.

International catalogue of scientific literature. M—Botany (*Internat. Cat. Sci. Lit., 3 (1905), pp. VIII+909*).—This is the third annual issue of the catalogue of scientific papers published under the auspices of the International Council by the Royal Society of London. The plan is the same as that previously announced (E. S. R., 14, p. 637). The literature indexed is mainly that of 1903, the material employed having been received between March, 1904, and February, 1905. The author catalogue embraces about 5,000 titles.

FIELD CROPS.

The thorough tillage system for the plains of Colorado, W. H. OLIN (*Colorado Sta. Bul. 103, pp. 32, figs. 7*).—The methods of plowing, harrowing, subsurface packing, and summer fallowing in connection with dry farming are described; the importance of seed selection for semiarid conditions pointed out; and directions for the culture of different crops on semiarid lands are given. The annual rainfall in Colorado is recorded and the experience in dry farming in other States is noted.

In a limited cooperative experiment a field with a light seeding of wheat had as good a stand as a field seeded at nearly twice the rate, due to the difference in the size of the kernels. The rate of seeding different grain and forage crops in dry farming is given in a table.

Of the spring wheat varieties Kubanka durum has appeared best adapted to the dry land areas of Colorado, and among the winter wheats Turkey Red has given the

most satisfactory yields. *Bromus inermis* has proved to be one of the best drought-resistant grasses brought into the State. *Agropyrum occidentale* is considered one of the hardiest and best native hay grasses.

It is stated that when the straw necessary to produce a bushel of wheat is estimated at 90 lbs. the water required in Colorado to produce 1 bu. of grain amounts to 56.25 tons. It is pointed out that more moisture is required to mature crops under semi-arid than under humid conditions. Ranking from lowest to highest in the amount of water required for maturity, the common field crops are given in the following order: Corn, potatoes, wheat, barley, field peas, oats, alfalfa, and red clover.

Fallow culture of chernozem, S. V. SHCHOOSYEV (*Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6* (*1905*), *No. 1, pp. 1-9*).—The results of fallow and rotation tests conducted at Ploti for several years are discussed.

In one system of fallowing the land was plowed in the fall or in the spring and left without a crop, while in the other an intercultural crop like mustard, buckwheat, vetches, etc., was grown after plowing and before sowing the winter grain. Under the first system fall-plowed land is known as the black fallow and the spring-plowed soil as early, medium, or late green fallow, according to the time of plowing from early in spring to the end of June. The following rotation was practiced: First year, black fallow with the plowing from 7 to 10½ in. deep; second year, winter rye or winter wheat; third year, spring wheat, oats, or barley; fourth year, root crops; fifth to eighth years, grass and leguminous crops, and ninth year, flax, millet, or wheat.

Early green fallow gave slightly lower yields than the black fallow, but is considered by the author as preferable. Perennial grasses in the rotation proved effective in the improvement of the soil. Winter wheat proved more profitable than winter rye.—P. FIREMAN.

Fertilizer demonstration work in 1904, H. SVOBODA (*Ztschr. Landw. Versuchsw. Oesterr.*, *8* (*1905*), *No. 9, pp. 834-845*).—These demonstration tests were carried on in the locality of Kärnten by 256 farmers, of whom 173, or about 68 per cent, reported results. The year before 211 had carried on this work and 137, or 65 per cent, reported the results secured.

Of the reports received the first year 42.6 per cent, and of those received the second year 50.5 per cent were used in the compilation of the average data. On meadows Thomas slag and 40 per cent potash salt were used in quantities furnishing 70 kg. of phosphoric acid and 65 kg. of potash per hectare, respectively. In the cereal and hoed crop tests the nitrate of soda used furnished 24 kg. of nitrogen; the superphosphate, 55 kg. of phosphoric acid; and the 40 per cent potash salt, 42 kg. of potash per hectare. The cost of the plant-food elements per kilogram was 34 heller for phosphoric acid in Thomas slag with 18 per cent total phosphoric acid, 43 heller for superphosphate with 18 per cent of water soluble phosphoric acid, 194 heller for nitrogen in the form of nitrate of soda, and 29.5 heller for potash in 40 per cent potash salt.

The fertilizer application on meadows more than paid for itself in the first cutting of grass, so that the second cutting and the increase of the growth the next year are regarded as clear gain. The increase in yield apparently due to the fertilizer ranged from 30 to 40 per cent. In the field crop experiments the results also proved profitable. An increase of 40 per cent in the yield of oats and of over 50 per cent in straw was obtained during the 2 years. The yield in potatoes was increased by 41 per cent the first year and by 24 per cent the second.

The influence of cultivation of moorland meadows on the yield and on the effectiveness of commercial fertilizers, E. WEIN (*Deut. Landw. Presse*, *32* (*1905*), *No. 89, p. 745*).—The results obtained by the moor culture station at Weihanstephan showed that the use of commercial fertilizers on meadows of this class without cultivation is unprofitable.

The removal of the moss from the surface by means of a harrow and the subsequent sowing of grasses and other leguminous plants aerated the surface soil and produced a good effect, but it was inadequate for the complete utilization of the commercial fertilizers applied. The best success was obtained when the original sod was plowed up, well worked, and sown to clover and grass. In this way the soil was sufficiently aerated, good forage secured the first year, and the land freed from weeds. For the first year an application of 200 kg. of potash and 150 kg. of phosphoric acid, and for the second year 120 to 150 kg. of potash and 100 kg. of phosphoric acid per hectare are recommended.

For the formation of a new sod 40 per cent potash salt is considered best, while for the maintenance of an old soil kainit may be used instead. Phosphoric acid is generally applied on these meadows in the form of Thomas slag, but superphosphates are also effective. Of the raw phosphates lime phosphate only proved satisfactory. Lime rendered the soil more friable, promoted aeration and bacterial development of the soil, and so acted indirectly in furnishing plant food. The applications of commercial fertilizers were effective in direct proportion to the cultivation given.

Report on the experimental farms in the Central Provinces for the year 1904-5, C. E. Low (*Rpt. Expt. Farms Cent. Prov. [India], 1904-5, pp. 32*).—The work for the year 1904-5 at the several experimental farms, including a cattle breeding farm and a seed farm, is reviewed.

The experimental results obtained establish the superiority of nitrate of soda as a top-dressing in connection with irrigated crops to most other forms of fertilizers. Upland Georgian cotton acclimatized on the farm during the last 10 years was distributed in several districts and gave promising results. In experiments with rice, transplanting gave by far the best results over the untransplanted crop. An awned variety of *Pennisetum typhoideum* maintained its superiority and is becoming popular among cultivators.

Selections made from *Andropogon* sorghum excelled the older strains in both yield and quality of grain. Brief notes on work with cowpeas, peanuts, and other forage crops are given.

Guide to experiments conducted at Burgoyne's (university) Farm, Impington, and at other centers in the eastern counties, T. H. MIDDLETON (*Cambridge Univ., Dept. Agr., Guide to Expts., 1905, pp. VIII+67, plan 1, dgms. 4*).—Results of cooperative experiments with different field crops are reported in tabular form with brief notes.

The Long Red mangel was apparently the leading variety on all deep fertile soils, while for general purposes on soils not suited to this variety the Globe and Tankards did best. The Yellow Globe, as shown by experiments at two centers, yielded 29.9 tons of roots containing 3.2 tons of dry matter and 1.88 tons of sugar per acre; while Long Red, with the same yield of roots, produced 3.92 tons of dry matter and 2.36 tons of sugar. The results of 3 seasons' tests at Burgoyne's (university) Farm show that Sutton Long Red produced 81 cwt. of dry matter per acre as compared with 66 cwt. for Carter Windsor Yellow Globe.

In studying the effect of fertilizers on the composition of mangels it was found that individual large roots are often richer than individual small roots. In the case of Long Red mangels, as the size increased from 2 to 3 lbs. the dry matter decreased 0.7 per cent; from 3 to 4 lbs., 0.6; from 4 to 5 lbs., 0.4; from 5 to 6 lbs., 0.3; and from 6 to 7 lbs., 0.2 per cent. In fertilizer tests with swedes the effect of omitting phosphates was marked. The use of a complete application increased the weight of the roots and decreased the percentage of sugar.

Findlay British Queen ranked first in a variety test with potatoes with an average yield of 12 tons 6 cwt. of merchantable tubers. Whole sets for seed gave better

results than tubers cut in 2 or 3 pieces, and the larger cuttings produced heavier yields than the smallar ones.

Thousand Dollar and Banner, both Canadian varieties of oats, ranked first in the average yields of grain and straw for 3 years. In a rotation test the best effect on the yields of mangels, oats, and hay was secured where $\frac{3}{4}$ cwt. of sulphate of ammonia, $1\frac{1}{4}$ cwt. of nitrate of soda, 6 cwt. of superphosphate, $1\frac{1}{2}$ cwt. of sulphate of potash, and 10 tons of barnyard manure per acre were applied to mangels.

The agathi plant (*Dept. Agr. Madras Bul. 52, pp. 21-30*).—Notes are given on the growth of this plant in connection with the cultivation of the betel vine, which is trained upon it. In addition to this, its principal use, the leaves and tops of the plant are used for forage.

Under what conditions does potash fertilization reduce the protein content of malting barley? O. Reitmair (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 10, pp. 863-944*).—This article is a review of experimental work by different investigators on potash fertilization and its relation to the protein content of barley. Many of the data discussed are tabulated and a list of 35 references consulted in the preparation of the article is given.

Basing his conclusions on the data reviewed, the author points out that soil and climatic conditions unfavorable to the production of malting barley can not be offset by applying potash. If the climate is favorable and the soil too rich, a change in the crop rotation will be more effective than potash fertilization. It is believed that weather conditions most largely control the low protein content of barley, and that if the soil contains sufficient available nitrogen none should be given in the fertilizer, or the quantity should be small. Potash applied under these conditions, especially on soils in need of the element, may reduce the protein content in connection with an increase in the yield but this does not always occur.

As chemical analyses do not indicate that a soil will be benefited by potash application, this must be determined by experimentation. A soil poor in nitrogen may be given a rather heavy application of nitrate of soda without perceptibly influencing the protein content of the grain and potash in such cases may reduce the protein in the kernel, but this depends upon whether the soil responds to potash. An increase in the nitrifying power of the soil due to frequent cultivation, especially on deep fertile soils, may for a time make the soil less suited to the production of low protein barley.

It is stated that good malting barley contains from 9 to 11 per cent of protein in the dry matter, or from 8 to 10 per cent in the air-dry grain, with 10 per cent of moisture. Deep, well-drained loess soil, uniform in the size of the soil particles and of good texture, is considered best for the production of barley low in protein. The productivity of a soil for this purpose should be more dependent upon a favorable distribution and conservation of the soil moisture than upon the plant food it contains. Good malting barley is also produced on heavier and lighter soils than the kind just described, but the production of a crop of the desired quality is less certain. During the periods before and after heading a uniform, uninterrupted, and adequate moisture supply is the most important factor in determining the quality of the product, and these conditions are most likely to obtain in a loess soil.

Owing to its rather small root system and its limited time of growth, the development of spring-sown barley goes on very rapidly before heading, and the plant under these conditions may take up large quantities of nitrogen and other plant foods. After the heads have appeared the formation of dry matter is believed to go on more rapidly than the absorption of plant food, and if the moisture supply is insufficient at this period the quantity of nitrogen taken up is too large as compared with the amount of dry matter formed, and a grain high in protein and ash is the result. In this connection the influence of climate, season, and rainfall is indicated and the value of improved varieties is discussed.

According to the author, the principal point brought out in the work reviewed is that potash fertilization reduces the protein content only when the quantity of available potash in the soil is at a minimum, and especially on the less fertile soils when a heavy application of nitrogen has been given.

Under what conditions does potash fertilization reduce the protein content of malting barley? J. STOKLASA (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 11, pp. 957-982*).—A controversial article in answer to O. Reitmair.

The importance of the stooling capacity in cereal breeding, J. SPERLING (*Fuhling's Landw. Ztg., 54 (1905), No. 12, pp. 397-400*).—Individual wheat plants, ranging in number of stems from 6 to 22, were examined. The yield per plant was found to increase quite regularly with the number of stems, being 14.40 gm. per plant in the group with 6 stems and 49.29 gm. for the plants with 22 stems.

Of the plants studied 7.92 per cent were low, 7.30 per cent medium, and 21.78 per cent high in stooling capacity. The plants with the medium number of stems were not only the most numerous, but also gave the highest average yield of grain per head. The author concludes from these results that for breeding purposes plants medium in stooling capacity should be selected.

Drilling clover seed with the nurse crop, BACHMANN (*Deut. Landw. Presse, 32 (1905), No. 98, p. 814*).—The results obtained show that germination and initial growth on the drilled plats were of greater regularity than on those sown broadcast, and that the stand of clover where broadcasted was uneven, while on the drilled plats it was regular. The soil between the drills when the clover was 4 to 5 in. high was completely covered, and Italian rye grass, which was sown with the clover, developed perfectly.

Selecting and preparing seed corn, P. G. HOLDEN (*Iowa Sta. Bul. 77, rev. ed., pp. 167-230, figs. 43*).—A revised edition of a bulletin previously noted (E. S. R., 16, p. 40) containing in addition to matter already published a report on seed corn tests made in 1905. Directions for storing seed corn and for testing each ear are also added.

Over 3,300 samples of seed corn representing every section of the State, and each sample consisting of 200 kernels taken from 100 ears of each farmer's seed, were tested. The average results of these tests show that approximately 19 per cent of the seed was entirely dead, 21 per cent low in vitality and unfit for planting, and only about 60 per cent good seed with strong, vigorous germination and giving a promise of well-developed, productive plants.

Observations on the stand were made in more than 1,000 different cornfields and it was found that in some the stand was only 40 per cent of perfection, while in others it ran as high as 95 to 96 per cent. It is estimated from these observations that on the average for the State the actual stand was about 65 per cent of a perfect stand.

In another experiment seed secured from 90 different farmers living within a radius of 10 miles from the station was compared. The experiment was repeated 3 times under identical conditions. The average yield of the 6 highest-yielding samples was at the rate of 77.5 bu. per acre, and of the 6 lowest-yielding, 35.6 bu. The yields of these 12 samples ranged from 31.5 to 80.5 bu. per acre.

The amount of water used by growing corn, R. W. CLOTHIER (*N. Dak. Farmer, 7 (1905), No. 1, pp. 5, 6*).—Three stalks of corn were grown in the open in a cylinder 18 in. in diameter and 4 ft. high, filled with soil. At the bottom of the cylinder was a reservoir shut off from the air. The soil was saturated with water and the reservoir filled.

The water used by the plants was measured by the quantity required to keep the level in the reservoir constant as corrected by the loss due to evaporation from a check cylinder. During the 24 days prior to July 12, when the plants were beginning to silk, 7 in. of rain fell and in addition 132 lbs. of water was required to keep

the level in the reservoir constant. Since the plants were 2 ft. high a daily average of 3 lbs. of water was used per stalk, which is equivalent to a rainfall of 1 in. every 7½ days.

What is an ear of corn? E. G. Montgomery (*Pop. Sci. Mo., 68 (1906), No. 1, pp. 55–62, figs. 14*).—The observations made suggest to the author that corn and teosinte may have had a common origin, the progenitor of these plants probably being a large much-branched grass, each branch being terminated by a tassel-like structure bearing hermaphrodite flowers

In the process of evolution the cluster of pistillate spikes in teosinte is considered as having developed from the lateral branches of a tassel-like structure while the corn ear developed from the central spike. It is further indicated as probable that the central tassel, as evolution progressed, produced only staminate flowers while the lateral branches produced only pistillate flowers, and that this differentiation was accompanied by a shortening of the internodes of the lateral branches until they were entirely inclosed in the leaf sheaths, as is the case with en ear of corn.

Weevil-resisting adaptations of the cotton plant, O. F. Cook (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 88, pp. 87, pls. 10*).—This bulletin contains an account of observations and experiments showing that some of the varieties of the cotton plant have definite weevil-resisting characters.

One of the first results in this line of work was the discovery of the weevil-eating kelep. It appears from these observations, however, that the usefulness of the insect is not limited to weevil destruction, but that by making a regular field culture of cotton possible in regions infested with the weevil it has contributed to the development of weevil-resisting characters in the plant. These characters are regarded as modifications in the plant for the purpose of self-protection against its insect enemies.

The general protective characters, the involucre as a protective structure, and the protection of the bolls and of the seed are discussed at some length. The extrafloral nectaries of the cotton plant are described and their functions as insect-attracting devices pointed out. A description of the behavior of the parasitized buds is also given.

Discussions on the cultural value of Kidney cotton, the nature and causes of weevil-resisting adaptations, and the improving of varieties by conscious and unconscious selection are presented. The different adaptations are classified as avoiding weevils, excluding weevils, attracting the kelep, and preventing the development of weevil larvæ. The adaptive characters of different types of cotton, including Kekchi, Rabinal, Pachon, San Lucas Sea Island, Kidney, and upland cottons, are also listed.

In an experiment conducted in Guatemala it was found that plants of Kekchi cotton cultivated on the United States system were much more robust and compact than the plants grown by the Indians in more crowded fields. Considerable variation in this cotton was observed even among plants grown from seed raised by the same Indian, and this fact is considered as giving promise of securing strains having the special characters required in the United States. On the other hand it was found that Guatemalan conditions cause variation in United States varieties. King lost most of its distinctive characters and broke up into a variety of types and in general receded in earliness. Allen, Sea Island, and Egyptian varieties became more precocious and in some instances gained in vigor and productiveness. Kekchi cotton in Texas grew large and rank but began to fruit toward the end of July, giving promise of successful seed production under the prevailing climatic conditions.

A test of Kekchi cotton was made at Lanham, Md., in 1905, and while this locality is at the northern limits of cotton cultivation, this variety produced more mature plants than any of the domestic and foreign varieties compared with it. It also remained more constant in Maryland than did King in Guatemala. When light frosts occurred in this locality about the end of September the Kekchi plants did not suffer more than the American upland varieties. Pachon cotton from western Guatemala grew from 52 to 79 in. high and produced no buds at Victoria, Tex.,

while at Lanham, Md., it grew to a height of only 30 to 40 in., and produced numerous buds. The Kekchi cotton plants in the experimental plats were characterized mainly by the long basal branches.

It was observed that the smooth Egyptian and Sea Island varieties were more susceptible to weevil injuries than the hairy upland sorts, and that the boll weevils prefer the smooth varieties while the keleps find the hairiness of the plants, such as those of the upland varieties, and especially of the Kekchi cotton, to their advantage. Kelep nests were found at the bases of only 41 per cent of United States upland and Sea Island varieties as compared with 76 per cent of the plants of the Kekchi cotton. The hairiness of the stalks assists the kelep in traveling over the plant, while to the boll weevil it is a serious hindrance.

Dimensions of floral buds and bracts of several varieties of cotton were compared and it was found that in Parker, King, and Allen the bracts very seldom attain a width of 30 mm., while in the Kekchi cotton the average width for all except the smallest buds was above 30 mm. The larger bracts permit the involucre to be more effectively closed, and thus constitute a distinct weevil-resisting adaptation.

Proliferation of internal tissues of the buds seemed more frequent in the Kekchi cotton than in any of our domestic varieties. Proliferation, or growth inside of the bud of loose watery tissue, prevents the development of the larvæ. It was found that the proportion of weevil punctures rendered ineffective by proliferation ran well above 50 per cent, and sometimes reached as high as 80 and 90 per cent. Observations on Parker cotton bolls showed that proliferation was complete in 24 hours after the injury had been inflicted.

"The weevil-resisting characters are much more highly developed in the variety of cotton cultivated by the Kekchi Indians of eastern Guatemala than in any other type yet known, and it produces also large bolls and lint of good length and quality, so that it may be of value in the United States. But even though the Kekchi cotton in its present form should prove, for any reason, not to be adapted to cultural conditions in the United States, it demonstrates at least the fact that the upland type of cotton is capable of assuming other characters which will render it far better adapted to cultivation in the presence of the boll weevil than the varieties hitherto grown in the United States."

Cotton growing in Guilford County, J. H. Bluford (*N. C. Agr. and Mech. Col. Bul. 1, pp. 12, figs. 2*).—Culture experiments with cotton were conducted on an almost entirely clay subsoil from which the soil had been removed and on which soiling crops had been grown for a few years with partial success for the purpose of adding humus.

Barnyard manure and commercial fertilizers were applied alone and in combination. The rows receiving barnyard manure and commercial fertilizers gave the largest yield at first picking and the rows treated with barnyard manure alone gave the largest percentage of the total yield at the second and third pickings. The largest average total yield was obtained from the rows treated with barnyard manure alone.

The culture of cotton in Argentina, C. D. Girola (*El cultivo del algodonero en la República Argentina. Buenos Ayres: P. Gadola, 1904, pp. 99, figs. 14*).—A general treatise on cotton culture with historical notes on the industry in South America, and particularly in Argentina; descriptions of the plant, its species, varieties, and most important hybrids; discussions on the climatic requirements of the crop; a classification of fibers; and statistics on production. The results of cultural tests with cotton in Argentina are briefly reviewed.

Report on the possibilities of cotton growing in the East Africa Protectorate for 1904, A. Linton and E. Brand (*London: Harrison & Sons, 1905, pp. 17*).—A report presented to Parliament summarizing the work done in cotton culture and briefly describing the different cotton districts. Meteorological records for the region are tabulated and general directions for growing cotton are given.

The lands suitable for cotton culture in the Protectorate are estimated at 1,340,000 acres, including 1,250,000 acres of coast lands, which are best adapted to the crop.

The specific effect of phosphoric acid on oat plants grown on black peaty sand, H. CLAUSEN (*Jour. Landw.*, *53* (*1905*), *No. 3*, *pp. 213–228*, *fig. 1*).—The results of a series of pot experiments showed that on this soil the use of phosphoric acid regularly increased the total yield and decreased the relative yield of grain.

Dryness and aeration of the soil reduced the effect on the yield of grain, while moisture and a lessened aeration so increased it that even the absolute yield of grain was largely diminished. The average data also indicate a reduction in the yield of grain when the total yield is increased by means of phosphoric acid. The application of this element seems to interfere with the translocation of material within the oat plant, and the fact that it favors the production of new shoots from the lower node after the main stem has headed is considered a good basis for this conclusion. The growth of these younger shoots is made at the expense of grain development.

It was also observed that the plants receiving phosphoric acid had bluish-red stems while the stems of those grown without an addition of this element were light yellow in color. It was shown by chemical analysis that the bluish-red plants contained much more lime but considerably less oxid of iron than the light yellow ones.

The effect of soil compression on the development of oats, C. VON SEELHORST AND KRZYMOWSKI (*Jour. Landw.*, *53* (*1905*), *No. 3*, *pp. 269–278*).—Field experiments in this line have been previously reported (E. S. R., 13, p. 541).

In the work here described plants were grown in vegetation boxes and the effect of compacting the soil was noted. Oats were sown April 14, and on May 11 the soil was compacted in one box while in the other the surface was hoed. From the results secured it is concluded that rolling reduces the tendency to lodge mainly because it retards the general development of the plant by lessening the air supply of the roots, decreasing nitrification in the soil, and reducing root growth. The reduction in the general growth of the plant is especially marked in the early vegetative period.

This soil treatment also retards heading, and it is believed that this results in a shortening of the lower internode and possibly a thickening of the stems and a strengthening of the cell walls. A top-dressing of nitrate of soda is recommended to counteract a possible reduction of the yield through rolling.

The influence of soil moisture on the development of oats at different stages of growth, C. VON SEELHORST and KRZYMOWSKI (*Jour. Landw.*, *53* (*1905*), *No. 4*, *pp. 357–370*).—Oats were grown in 24 pots, each filled with 22 kg. of soil adequately fertilized.

Sixteen kernels were sown in each pot, but the stand was later thinned to 8 plants. The pots were divided into 2 series, the first being kept dry in the beginning and watered later on, and the second being kept moist at first with no water applied during the later stages of growth. In the first series the check pots received no water and in the second they were supplied with moisture during the entire period of the test.

The results showed that when water was supplied in the first series beginning with July 1, the increase in total yield was 27.7 per cent; beginning with June 15, 48.8; June 1, 103.2; May 15, 136.3; and May 1, 178.9 per cent. The corresponding increases in the yield of grain were 21.4, 40.1, 107, 126.3, and 158.7 per cent. In the second series, in which the water supply was discontinued on these dates, the total yields based on the yield of the check test as 100 per cent, were as follows: July 1, 85.8 per cent; June 15, 67.3; June 1, 52.3; May 15, 44.3; and May 1, 41.3 per cent. The corresponding yields of grain amounted to 74.4, 62.3, 48.6, 44.8, and 40.8 per cent of the yields in the check tests.

The influence of the moisture content of the soil on the structure of the plant, and particularly the development of the panicle, is also briefly noted.

The structure of oat and barley stems and its relation to production, C. Kraus (*Centbl. Agr. Chem., 34 (1905), No. 10, pp. 665–668*).—Observations were made on plants from two different localities, as well as those grown on fertilized and unfertilized soil and in drills and broadcast.

Varietal differences in leafiness were more apparent in barley than in oats. The average total number of leaves and the number of basal leaves per plant was greater in the forms of *Hordeum distichum erectum* than in those of *H. distichum nutans.* Secondary stems of both barley and oats were less leafy than the initial stems. In both species the larger number of leaves was borne on the upper part of the stem. The percentage of basal leaves was smaller for barley than for oats, and in both crops the secondary stems were provided with a smaller number of basal leaves than the primary stems. The length and weight of the stems increased with the number of internodes.

No definite correlation was shown between the length, thickness, and weight of the different internodes and their total number. Long stems were found to be heavier than shorter stems with an equal number of joints, and the internodes were longer and thicker. A closer relation seemed to exist between length and thickness of the internodes than between thickness and weight. The long, thick, heavy stems of both oats and barley produced the longest and heaviest heads.

Cooperative variety tests with peas, 1902–1904, W. Edler (*Arb. Deut. Landw. Gesell., 1905, No. 109, pp. 102*).—Of the 6 varieties of peas grown Weende Victoria gave the best average yield, and the common small yellow field pea, which stood last in the average yield of peas, gave the highest yield of straw. Weende Victoria ranked second in straw production.

The longest vines were produced by Weende Victoria, Strube Yellow Victoria, and the common small yellow field pea, and the longest pods by Strube Yellow Victoria, Weende Victoria, and Strube Green Victoria. Strube Yellow Victoria produced the largest and heaviest peas. The varieties producing small-sized peas gave the highest weight per liter, while those producing the largest sized peas gave the lowest weight per liter. Evergreen Folger was the earliest variety tested. The Blue Green English pea showed the least tendency to lodge.

Varieties of potatoes, W. Bruce (*Edinb. and East of Scot. Col. Agr. Bul. 6, pp. 4*).—Cooperative experiments were made in 1904 for the purpose of testing new varieties of potatoes.

Of the 13 varieties grown Pink Blossom, Factor, Up-to-Date, Twentieth Century, and British Queen were most satisfactory when both quantity and quality are considered. In the different experiments the same varieties held approximately the same rank. Langworthy, which is unequaled for quality, and White Blossom ranked last in yield in every test. British Queen, Up-to-Date, and Langworthy are old varieties grown as standards for comparison.

The effect of commercial fertilizers on the quality of root crops and potatoes, M. Weibull (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 3–4, pp. 161–179*).—Experiments were conducted with sugar beets in 1901 and 1902, and with fodder beets and potatoes in 1903 and 1904.

In 1901 the highest sugar content was obtained with the use of 200 kg. per hectare of nitrate of soda alone, or from an application of 400 kg. of nitrate of soda and 300 kg. of superphosphate. The beets grown in these applications were from 3 to 4 per cent higher in purity than those which received 200 kg. of nitrate of soda and 300 kg. of superphosphate per hectare. These results were confirmed the following year, but the purity being very high in all cases was not affected in so marked a manner.

In all the tests nitrate of soda alone greatly increased the yield of sugar, but when applied with superphosphate the results were not quite so good. Superphosphate, although not uniform in its effect, showed a tendency to reduce the purity, and

where potash was given in addition the sugar content was also slightly reduced while the purity of the juice and the yield of sugar were not materially affected. These results are regarded as confirming, in general, the work of Maercker (E. S. R., 12, p. 531), and showing that as the quality of modern improved sugar beets is not appreciably influenced by the common kinds of fertilizers, including peat poudrette, sugar factories are not warranted in placing restrictions on the kinds or amounts of fertilizers used by beet growers.

In the experiments with fodder beets the largest quantities of dry matter were obtained from the heaviest applications of fertilizers in general use, while the highest percentages of dry matter were secured where no fertilizers were given. The composition of the beets showed that the character of the fertilization did not appreciably affect their food value.

The lowest yields of potatoes were secured where no fertilizers were used, medium yields on plats receiving superphosphate and potash, and the highest yields of tubers or starch on the plats treated with complete fertilizers. As in the case of fodder beets, the fertilizers applied placed the yield and quality in inverse ratio to each other.—F. W. WOLL.

Serradella and red clover in rotation, R. GUTHKE (*Deut. Landw. Presse, 32 (1905), No. 96, p. 799*).—It is reported that on the heath lands of Lüneburg serradella is not successful when following red clover, and that results are also unsatisfactory when red clover follows serradella.

Fertilizer tests with sugar beets in 1901 and 1902, S. L. FRANKFURT ET AL. (*Kiev, 1905, pp. IV + 561; rev. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 4, pp. 471, 472*).—Fifteen cooperative tests were made in 1902. In every instance the use of superphosphate and nitrate of soda in combination improved the yield, the increase varying from 107 to 11,077 lbs. per acre. In general a better quality was obtained, the increase in sugar content ranging from 0.1 to 1.7 per cent.

The superphosphate in most tests seemed more effective than the nitrate of soda, and a quantity furnishing 27 lbs. of phosphoric acid per acre and applied in the drill was apparently most advantageous. The quality of the beets was not unfavorably affected when nitrate of soda was applied. Small applications of nitrate of soda proved effective, and quantities not exceeding 50 lbs. per acre gave the best results. Even in quantities furnishing only 7 lbs. of phosphoric acid per acre superphosphate gave a noticeable increase in yield and in general seemed to give better results than Thomas slag.—P. FIREMAN.

The use of shelled and disinfected beet seed (*Deut. Landw. Presse, 32 (1905), No. 100, p. 831*).—The use of beet seed from which the hull of the seed boll has been removed is discussed and the advisability of disinfecting seed is pointed out. The advantages of shelled and disinfected seed are given as follows: (1) A reduction in the volume of the seed, (2) a greater regularity in seeding with a smaller quantity of seed used, (3) quicker germination, and (4) the destruction of parasites. It is stated that the use of this kind of seed is spreading.

Comparative analyses of varieties of cane, C. F. ECKART (*Hawaiian Sugar Planters' Sta., Div. Agr. and Chem. Bul. 12, pp. 20*).—The results of a chemical study of 17 varieties of cane are tabulated and discussed.

It was found that the various varieties when grown under like conditions made different demands upon the plant foods of the soil. It is pointed out that Striped Singapore contained 7.7 lbs. of nitrogen for each ton of solid matter produced as compared with only 4.2 lbs. for Demerara No. 117. For each ton of solid matter Demerara No. 74 had taken up 8.4 lbs. of phosphoric acid and Queensland No. 1 only 3.7 lbs. Demerara No. 74 also stood first in the quantity of potash with 35.1 lbs., and less with regard to lime, the quantity appropriated being only 3.9 lbs. The largest quantity of lime, 7 lbs. in each ton of solid matter, was found in Louisiana Striped. The analyses further showed that during the development of different crops the same

variety can differ materially as to the percentage of its nitrogenous and mineral constituents.

The relative development of the leaves and stalk, as shown by this work, is modified chiefly through climatic and soil conditions and it is pointed out that as the different parts of the plant may show different percentages of the various elements, a variation in the chemical composition of the same variety may occur during two different seasons. It is concluded that as physical and chemical changes in the soil are continually taking place the growth of the cane as well as its chemical composition may be modified from one season to another.

Manurial and other experiments with sugar cane, J. P. d'Albuquerque and J. R. Bovell (*Rpt. Agr. Work, Imp. Dept. Agr. West Indies, 1902–1904, pt. 1, pp. 4–47*).—A summary of the results of experiments carried on at Dodds Botanic Station and at five plantations in different typical localities of the island.

The soil at Dodds was of low fertility, being deficient in the mineral constituents of plant food. The plat receiving 20 tons of barnyard manure per acre gave a yield of 27.9 tons of cane, and the one receiving 40 tons 32.4 tons of cane. The use of phosphoric acid and potash in addition to the barnyard manure diminished the yield by 4 tons. The results indicated that from 60 to 80 lbs. of nitrogen in the form of nitrate of soda or sulphate of ammonia, and from 80 to 100 lbs. of potash applied early reduced the richness and purity of the juice, and that the combination of commercial fertilizers and barnyard manure gave canes yielding a slightly larger percentage of juice.

The soil on the Foursquare plantation contained an abundance of available phosphoric anhydrid. The average yield of plats receiving 35 tons of barnyard manure per acre was 28.7 tons of cane, and the results in general showed that on this field the use of commercial fertilizers in addition to 35 tons of barnyard manure per acre was not advisable for a plant cane crop.

The experiments at Hopewell plantation were conducted on an exceptionally rich clay soil. An application of 60 lbs. of nitrogen as sulphate of ammonia produced an increase of 3½ tons of cane, while when given with phosphoric acid and potash the increase was 5 tons and when the quantity of nitrogen was reduced to 40 lbs., 6½ tons. On another field a similar series of experiments was conducted with a ratoon crop. Here the best results were obtained where 50 lbs. of potash was given in January and 40 lbs. of nitrogen as sulphate of ammonia in June to plant canes, followed by 80 lbs. of nitrogen as nitrate of soda and sulphate of ammonia to ratoons. This soil was rich in nitrogen and phosphoric acid, and received before the canes were planted 40 tons of barnyard manure per acre.

On a series of one-acre plats the results showed that where 35 tons of barnyard manure was used the application of sulphate of ammonia in quantities of 200 to 400 lbs. gave increased yields amounting to from 1 to 7 tons of cane and that the use of superphosphate did not affect the yield, while an application of 250 lbs. of basic slag per acre gave an increase of 1½ tons of cane. Where 30 tons of barnyard manure was used per acre an application of 100 lbs. of sulphate of potash in addition to nitrogen and phosphate gave an increase of about 2½ tons.

Experiments with varieties of sugar cane, J. P. d'Albuquerque and J. R. Bovell (*Rpt. Agr. Work, Imp. Dept. Agr. West Indies, 1902–1904, pt. 2, pp. 57*).—The experiments here reported were conducted at Dodds Botanic Station and at 17 different plantations. In the black soil estates the best results as plant canes were obtained with B 1529, which gave a large yield and a rich juice. On the red soils B 208 stood first and B 1529 second. B 208 stands first in average yield for 4 years on both black and red soils. It is reported that plants and ratoons of this cane on red soils were about 12 per cent higher than those of the White Transparent variety. B 147, while giving markedly good results in 1 or 2 districts, did not appear to ratoon well on the red soils.

During the season of 1902–1904, 2,843 varieties of cane were raised from seed and planted out, making a total of 20,000 varieties raised from seed since 1898. Of these, 6,000 varieties have reached a second or third stage, and during this season a total of 5,574 varieties were still under cultivation and 653 varieties were reaped and analyzed. The principal varieties are briefly described.

The relation between stem and root development in the sugar cane plant, Z. KAMERLING (*Meded. Proefstat. Suikerriet West-Java, 1905, No. 83, pp. 17, pls. 5*).—A discussion of the subject with references to work by different investigators is given and the author's own results are reported.

It was found that in a single-bud cutting of cane the growing capacity of the bud was largely reduced when the roots were not allowed to develop; and likewise, when the growth of the bud was prevented the development of the roots was reduced. Cuttings with two buds treated in the same way gave similar results, but when the bud on one joint and the roots on the other were kept from growing, as by means of a band of plaster of Paris, the remaining uncovered bud and roots developed almost normally.

The results of this work, supplemented by those obtained in pot experiments, indicated that under normal conditions the development of the cane plant above ground is carried on with about the same degree of activity as the development of the root system.

Report of the division of agriculture and chemistry, C. F. ECKART (*Hawaiian Sugar Planters' Sta. Rpt. 1905, pp. 15–28*).—A report on the work of this division for the year ending September 30, 1905, is presented.

The field experiments with sugar cane and the work of the substations on the various islands are briefly noted. Cane was successfully grown from seed received in the form of pulverized cane tassels from Barbados, Jamaica, and Trinidad. The seed was sown December 21, February 4, and February 18. Cold weather retarded the growth of the early sown plants and a larger number of them died off than was the case in the later seedings.

A total of 812 seedlings was produced, of which 279 were planted in the field May 3 and July 18. On August 29, 46 of these young cane plants were replanted from cuttings, and on September 13, 47 more were treated in the same way. The remainder of the canes were allowed to flower during the fall to produce seed.

The value of shelled timothy seed, H. VON FEILITZEN (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 1, pp. 79, 80*).—The results of pot experiments indicated that shelled timothy seed for seeding purposes has a much lower value than whole seed.—F. W. WOLL.

A study of Deli tobacco, D. J. HISSINK (*Meded. Dept. Landb. [Java], 1905, No. 1, pp. 78; abs. in Jour. Landw., 53 (1905), No. 2, pp. 135–172*).—Fertilizer experiments on the Padang Boelan plantation were conducted from 1900 to 1902, inclusive, on soil rich in nitrogen and phosphoric acid but rather low in potash and lime.

An application of nitrogen seemed unnecessary, but the use of potash and phosphoric acid gave good results. The optimum quantity of potash per plant ranged from 1 to 1.3 gm. The use of 0.75 gm. of phosphoric acid per plant proved inadequate. The tobacco grown on this soil had a high nitrogen content, although nitrogen fertilization had little influence. The content of albuminoid nitrogen varied little and amounted to more than 50 per cent of the total nitrogen. The average nicotine content, 1.96 per cent, agreed with the average given by König. It was also observed that light and favorable moisture conditions promote the production of nicotine.

The fermented tobacco contained nitrate nitrogen, the quantity being greater in the lower than in the upper leaves. The percentage of amid nitrogen was lower than that determined by Behrens in European tobacco, and it is believed that the

transformation of albuminoids into amid compounds takes place to a lesser extent in tropical climates. An abnormally high percentage of total nitrogen was generally due to a large quantity of amid nitrogen. The tobacco grown on this plantation graded high in quality.

In studying the total quantity of calcium, magnesium, potassium, and sodium in the ash of tobacco it was found that in 1900 the position of the leaf on the stalk had no significance in this connection, but in 1901 the quantity was greater in the lower than the upper leaves. The average content for the 2 years was about the same. In 1900 the fertilizers applied exerted no influence, while in 1901 the quantity of the inorganic bases was increased somewhat by the use of phosphoric acid and potash. It did not appear that the total quantity of these bases is dependent upon variety and climate alone, the average for the entire plant being independent of weather conditions and, to a small extent, dependent upon fertilization. In the author's opinion a comparison of his own results and those of van Bemmelen with the data published by van Bylert seems to indicate that this factor is dependent upon the kind of soil.

Observations made on the reciprocal substitution of potash and lime indicate that the position of the leaf on the stalk influences its composition, the lower leaves containing more potash and the upper ones more lime. Favorable soil moisture conditions increased the potash and decreased the lime content. The total quantity of lime and magnesia in the entire plant varied with the potash content. The influence of the fertilizers was readily noticeable only when potash was given. Atterberg's method for the determination of plant food requirements of the soil by means of the analyses of the crops produced was applied in connection with these experiments, but in the opinion of the author the results showed that the rules he has laid down may lead to wrong conclusions with tobacco.

The storage and germination of wild rice seed, J. W. T. DUVEL (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 90, pt. 1, pp. 16, pls. 2*).—The distribution, habitat, and germination of the seed of wild rice are discussed; directions for storing the seed, packing it for transportation, and making germination tests are given, and the results of storage experiments reported.

Wild rice seed gathered as soon as matured, covered with fresh water before fermentation had set in, and stored at a temperature of 32° to 34° F., germinated as high as 88 per cent, or fully as good as fresh seed, after being in storage 393 days. Drying the seed, either when fresh or after it is taken from cold storage, destroys its vitality. The best results in germinating this seed were secured by covering it with water and changing the water in the dishes daily.

The seed germinated well at temperatures ranging from 15° to 30° C., and the experiments so far as carried out show that the maximum temperature of germination is about 35° C., but that better results are obtained at lower temperatures. Work of a similar nature has been previously noted (E. S. R., 15, p. 578).

Third annual report of the Central Seed-Testing Laboratory of the Aynsome Agricultural Station, J. S. REMINGTON (*Anysome Agr. Sta., Seed-Testing Lab. Ann. Rpt., 3 (1904-5), pp. 54, figs. 21*).—From September, 1904, to June, 1905, 1,296 seed samples were tested, the largest number being clovers, rye grasses, and seeds of root crops.

In one sample of red clover seed over 200 dodder seeds were found in 1 oz. The average germination for red clover during the season was 93.1 per cent; white clover, 83.5; perennial rye grass, 80.8; and Italian rye grass, 82.9. The germination and purity tests of all the samples examined are tabulated. The weed seeds most commonly found in clover and grass seed samples are enumerated and briefly noted.

The destruction of dodder, E. MARRE (*Prog. Agr. et Vit. [Ed. l'Est], 26 (1905), Nos. 22, pp. 648-654, pl. 1, figs. 4; 23, pp. 684-694, figs. 4; 24, pp. 722-726*).—This article, including a botanical study of different species of cuscuta, describes the means

by which these parasitic plants are disseminated and suggests measures for their prevention and destruction. The text of the French law regarding the destruction of cryptogams and other plants detrimental to agriculture is given in this connection and discussed.

HORTICULTURE.

Study of the causes which make the soil of old market gardens unsuitable for the culture of certain vegetables (*Bul. Mens. Off. Renseig. Agr.* [*Paris*], *4* (*1905*), *No. 9*, *pp. 1079–1082*).—Chemical analysis of old truck garden soil showed it to be more than twice as rich in all the elements of plant food as the best manure, and yet when such plants as corn salad or spinach were planted on this soil the latter part of August only very inferior crops were secured.

Analyses of the matter in the soil soluble in boiling water showed that it contained much less available plant food than the same soil earlier in the spring before cropping had begun. This, then, is considered to be the reason for the defective crops at this time—a lack of immediately available plant food due to exhaustion by 2 or 3 previous crops grown earlier in the summer. When the "dead" soil was treated with a dilute solution of carbonate of potash it was found that practically as much nitrogen and phosphoric acid was made available as was required for the production of good crops earlier in the season.

It is held, therefore, that if these "dead" soils are treated with some other agent which will liberate the potash of the soil in the form of carbonate of potash a full crop is assured.

A rust-resisting cantaloupe, P. K. BLINN (*Colorado Sta. Bul. 104*, *pp. 15*, *figs. 10*).—The cantaloupe rust or blight has for a number of years seriously injured the cantaloupe industry in Colorado in the vicinity of Rockyford. In dry seasons the disease may not excite much notice, while in seasons subject to rains and dews its development is very disastrous to the crop. The disease is caused by a parasitic fungus (*Macrosporium cucumerinum*). Attempts by the station to control the disease by the use of Bordeaux mixture have failed.

In 1903 it was observed that some of the plants in a number of fields which had been grown from a single strain of seed were much more resistant to the rust than others. Seed from these immune plants was obtained and planted in 1904 and likewise in 1905. A large proportion of the seed from these rust-resistant plants produced a healthy growth of vines and large solid melons with firm flesh and small seed cavities completely filled with seed, while unselected seed produced plants greatly injured by the rust, with small melons which ripened prematurely, thin watery flesh, large open seed cavities, and of practically no market value.

Upon investigation it was found that the rust-resistant plants traced back to an accidental selection made some nine years before by J. P. Pollock. In selecting muskmelons for seed attention should be paid to quality as well as rust-resistance. A schedule is given suggesting points which should be observed in melon seed selection. Muskmelons, which, from their outside marking appear to be satisfactory, should be cut open and examined in regard to size of seed cavity, character of flesh, etc. Observation at the station has shown that a close netted melon does not lose weight by evaporation as rapidly as one not so closely netted.

Fertilizer for peas, H. BLIN (*Prog. Agr. et Vit.* (*Ed. l'Est*), *26* (*1905*), *No. 33*, *pp. 294–299*).—A general discussion of the fertilizer requirements of peas, with tables showing the increased yield obtained when potash was used in addition to superphosphates on peas.

Manuring gumbo, H. BLIN (*Agr. Prat. Pays Chauds*, *5* (*1905*), *No. 31*, *pp. 347–352*, *fig. 1*).—An account of fertilizer experiments with gumbo or okra (*Hibiscus esculentus*) in which a complete fertilizer was compared with the different essential fertilizer elements separately.

The results of the experiments, which are tabulated, indicate that potash is especially useful in the culture of this crop. This element seems to especially favor the development of the pericarp or edible portion of the fruit. A formula consisting of 500 kg. nitrate of soda, 800 kg. basic phosphate, and 200 kg. sulphate of potash per acre is recommended as a general fertilizer for this crop.

The mutations of Lycopersicum, C. A. WHITE (*Pop. Sci. Mo., 67 (1905), No. 2, pp. 151–161, figs. 2*).—The author obtained 2 new species of Lycopersicum, which he has designated *L. solanopsis* and *L. latifoliatum*, by mutation from seeds of *L. esculentum*. The essential features of this work have been noted in an earlier publication (E. S. R., 13, p. 645). The author believes that these two cases of sudden mutation in the genus Lycopersicum are of essentially the same nature as those cases of mutation observed by Professor de Vries in the genus Œnothera.

The American peppermint industry, A. M. TODD (*5. Internat. Kong. Angew. Chem., 1903, Ber. 2, pp. 804–812*).—A brief historical account of the peppermint industry since it began in England in 1750, with an account of its culture on the large mint farms in Michigan and of methods of distillation.

Peppermint, ALICE HENKEL (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 90, pt. 3, pp. 15, figs. 3*).—Brief descriptions of American mint (*Mentha piperita*), black mint (*M. piperita vulgaris*), and white mint (*M. piperita officinalis*), with an account of peppermint culture in the United States, including planting, harvesting, distilling, and statistics on the production, export and prices of peppermint oil. Michigan produces the bulk of the crop grown in the United States. The number of acres grown in 1902 was 6,400 with an average yield of 12.8 lbs. of oil per acre. The price in 1905 ranged from $2.25 to $3.45 per pound.

Shading pineapples (*Agr. News [Barbados], 4 (1905), No. 90, p. 292*).—A note is given stating that an experiment was made in shading pineapple plants from the time of flowering until the fruit was ready to be cut. As a result the shaded plants were healthier and the fruits more perfect in shape than those unshaded.

Fertilizing apple trees, F. A. WAUGH (*Country Gent., 71 (1905), No. 2762, p. 14*).—This is an abstract of a paper presented by Prof. W. P. Brooks before the horticultural seminary of the Massachusetts Agricultural College.

Besides the discussion of the general principles which should obtain in the fertilizing of fruit trees, an account is given of an experiment begun in 1887 in which good agricultural land was planted with apple trees and the sections fertilized with different kinds of fertilizers. The trees were planted in 1890, and are now 15 years old. Data as to the fertilizers used and their cost, the average diameter of the trees at present, and the total yield to date are given in the following table:

Yield and growth of fruit trees differently fertilized.

Fertilizer used per acre annually.	Annual cost per acre.	Present diameter.	Total yield to date.
		Inches.	*Pounds*
Ten tons barnyard manure	$20	31.32	10,287
One ton wood ashes	12	27.52	5,463
Nothing		24.52	2,021
Six hundred lbs. bone meal and 200 lbs. muriate of potash	10	26.94	7,111
Six hundred lbs. bone meal and 400 lbs. low-grade magnesia-potash-sulphate	11	31.15	9,607

From the table it is readily seen that the largest trees and the heaviest yields resulted from the use of 10 tons of barnyard manure per acre. Very nearly as good results were obtained on the plat fertilized with bone meal and low-grade magnesia-potash-sulphate. The table likewise shows that the cost per acre was considerably greater when barnyard manure was used than with any of the other fertilizers.

When the muriate of potash was used in the place of magnesia-potash-sulphate the diameter growth of the trees and the total yield were considerably lessened notwithstanding about equal quantities of actual potash were supplied in each instance.

The varieties Baldwin, Gravenstein, Rhode Island Greening, and Roxbury Russet were used in the experiment and showed considerable variation in their responsiveness to fertilizers. The variety Roxbury Russet made very nearly as good growth where no fertilizer was used as where barnyard manure was applied. Baldwin, on the other hand, made a much more vigorous growth on the fertilized than on the unfertilized section.

A considerable difference in the results is noted in the matter of quality of fruit grown on the different sections. The best colored fruit was nearly always found on the plat fertilized with wood ashes, followed by that on the plat which received magnesia-potash-sulphate. The fruits on the unfertilized plat were firm, of good color and good flavor, but were altogether too small and a very large proportion of them was unfit for sale. The fruit on the plat fertilized with barnyard manure was poorest of all except in point of size. It was soft, rather poorly flavored, kept poorly, and was not well colored.

The relation of soil texture to apple production, H. J. WILDER (*Science, n. ser., 22 (1905), No. 570, pp. 715–719*).—The author discusses apple production as related to soil texture, exposure, etc., the discussion being based on the results of work done by the Bureau of Soils of the U. S. Department of Agriculture.

Apple trees grown on a deep sandy soil, while they produce fruit of good quality and color, are so short-lived as to make it inadvisable to plant orchards on this soil except for home use. On the other hand, when the trees are grown on very heavy clay soils, such as the Miami clay loam in Michigan, the Dunkirk clay in the Champlain Valley, the Hagerstown clay in Adams County, Pa., and on the Pikeville area in Tennessee, the apples are inclined to have greasy skins and an inferior color. The most successful commercial orchards are grown on loam soils between these two extremes.

Apple scions from bearing trees—Influence of the stock (*Rural New Yorker, 64 (1905), No. 2907, p. 741*).—In reply to a question as to the influence of selecting scions from bearing trees for top-working purposes the opinions of G. T. Powell, F. A. Waugh, F. W. Card, W. M. Munson, S. G. Maynard, and A. G. Gulley are given. In general, this practice is believed advisable, though no definite experiments on the subject are known to the writers.

Handling the apple crop, H. H. HUME (*Bul. N. C. Dept. Agr., 26 (1905), No. 9, pp. 22, figs. 16*).—Directions are given for harvesting, packing, and marketing apples.

The short apple crop of 1905 (*Amer. Agr., 76 (1905), No. 19, pp. 424, 425*).—The apple crop of the United States for 1905 is placed at 23,495,000 bbls. as compared with 45,360,000 bbls. in 1904, 42,626,000 bbls. in 1903, and 46,625,000 bbls. in 1902.

Pomology of Finistère, J. CROCHETELLE (*Quimperlé, France: Union Agricole, 1905, pp. 52 + 31, figs. 12*).—The author made a study of the apples of Finistère. Descriptions of the varieties grown and analyses of the juice of each variety are given.

Citrus fruit growing in the Gulf States, P. H. ROLFS (*U. S. Dept. Agr., Farmers' Bul. 238, pp. 48, figs. 17*).—Popular directions for the production of citrus orchards in the Gulf States, including all the details of soil selection, varieties, propagation, harvesting, shipping, protection from cold, top working, etc.

Citrus fruits in Hawaii, J. E. HIGGINS (*Hawaii Sta. Bul. 9, pp. 31, pls. 3, figs. 7*).—Directions for the culture of oranges, lemons, pomelos, and limes, with an account of the more serious diseases and insect pests affecting them.

Growing oranges under tents, H. V. HORGAN (*Country Calendar, 1 (1905), No. 8, pp. 717–719, 750, figs. 5*).—An account of the successful culture of oranges in the frosty regions of northern Florida by the aid of paper tents heated with a kerosene lamp during the early growth of the trees and protected later by high board

walls and wood fires. The illustrations given show how the tents were built and heated, the method of construction of the board walls, and the laying of the fires throughout the orchard.

The pomelo (*Mo. Consular and Trade Rpts.* [*U. S.*], *1905, No. 300, pp. 101–103*).—An account is given of the climate and soil requirements and the bearing capacity of Chinese pomelos. It is stated that this is the finest fruit in the far East, and its introduction and commercial culture in the United States are urged.

South Australian fruit at the Brisbane national show, G. QUINN (*Jour. Dept. Agr. So. Aust., 9* (*1905*), *No. 2, pp. 97–103*).—Tabulated data are given showing the date of picking, condition when packed, time of placing in storage, and the keeping quality of 7 varieties of pears, 1 of grapes, and 37 of apples.

Packing and marketing fruits, F. A. WAUGH (*St. Joseph, Mo.: The Fruit-Grower Co., 1905, pp. 63, figs. 12*).—Popular directions for harvesting and marketing the various orchard and small fruits.

Experiments in cold storage of fruit, J. KNIGHT (*Jour. Dept. Agr. Victoria, 3* (*1905*), *No. 2, pp. 158, 159*).—Notes on the keeping quality of a number of different varieties of apples and pears held in cold storage.

Sterilizing fruit (*Ann. Rpt. Bd. Agr. and Dept. Pub. Gard. and Plantations Jamaica, 1905, p. 11*).—An account of the successful preservation of mangoes, pineapples, chocho, gineps, avocado pears, akees, and bananas by canning.

The fruits were sterilized in the cans in a patent apparatus at a temperature of 150 to 155° F. for 4 hours, the water used being sterilized the previous day at 150° F. for 1 hour. The caps were adjusted and fixed with clips before placing the bottles in the water and hermetically closed during the sterilizing process. A bottle of mangoes thus preserved was opened 97 days after canning and found to be in perfect condition.

A method of preventing the rapid decay of ripe fruit (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 5, pp. 305, 306*).—Soft fruits like strawberries were immersed for 10 minutes in cold water containing 3 per cent of commercial formalin. On removal such fruit was immersed for 5 minutes in cold water and afterwards placed on wire netting or some similar open material to drain and dry. With fruit having a rind or skin that is not eaten, like bananas, mangoes, etc., the immersion in water after treatment with the formalin solution is omitted.

Fruits purchased from shops in the market and thus treated kept perfectly sound after a similar quantity of untreated fruit from the same lot had become moldy or decayed, as follows: Cherries 7 days, gooseberries 7 days, grapes 4 days, pears 10 days, and strawberries 4 days. In this experiment all of the fruit treated was perfectly ripe. It is thought that if the fruit had been treated at a little earlier stage the results might have been still better. This method of treatment, it is thought, will be of great commercial importance in shipping tropical fruits.

Preparation of fruit pulp (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 2, pp. 112–115*).—Methods of preparing various fruit pulps are described.

Hard fruits, such as apples and pears, are cut into small pieces without being peeled or having the cores or seeds removed and placed in cold water containing 1.5 oz. of salt to the gallon to prevent discoloration. The fruit is then boiled to a pulp and strained, a yield of about one-fifth the original weight being obtained. Plums and soft fruits are treated in practically the same manner. With plums the strained pulp is sweetened with about 4.5 lbs. of sugar to each cwt. of fruit and the boiling continued until the pulp is thickened sufficiently to hang from the spoon without dropping. With raspberries and strawberries the boiling must not be prolonged and the pulp need not be strained through so fine a sieve as in the case of plums.

"The principal points to which care should be devoted are the processes of boiling the fruit. The first boiling should be continued only so long as the consistency of the mass is such as will enable the pulp to pass through the sieve for straining, and

at the second boiling the pulp must not be allowed to get too thick, otherwise it will acquire a bitter flavor."

The use of lye in fruit canning (*Cal. Fruit Grower, 32 (1905), No. 906, p. 4*).—The method of the California Fruit Canners' Association at San José of using lye for eating off peach skins as a substitute for paring was investigated by a member of the California State Board of Health.

By this process the fruit is immersed in the hot lye and quickly passed into pure cold water, which is constantly changing and quickly washes away the alkali. The process is believed to be entirely cleanly and the fruit healthful, the peaches not being handled as they must be when peeled by hand. Two cans of peaches thus prepared were analyzed with reference to acid content. In both practically the normal amount of acid was found. It is stated that the same process is used with prunes.

Pimento growing in Jamaica, A. ROXBURGH (*Agr. News [Barbados], 4 (1905), No. 90, p. 295*).—Directions are given for growing pimento (*Pimenta officinalis*), or allspice, in Jamaica. The average annual production of pimento in Jamaica is placed at 50,000 to 60,000 bags of about 150 lbs. weight each.

Cultivation of tea in Jamaica (*Agr. News [Barbados], 4 (1905), No. 91, p. 309*).—An account of a tea plantation of 80 to 90 acres located at Ramble in St. Ann, Jamaica. The plantation was set out in 1896, and is at an elevation of 1,600 ft. above sea level. The trees are in good condition and the quality of the tea produced said to be first class. This is stated to be the only tea plantation in the West Indies.

The technology of tea, H. NEUVILLE (*La technologie du thé. Paris: Challamel, 1905, pp. 270, figs. 30*).

Manurial experiments with cacao at Dominica, F. WATTS (*West Indian Bul., 6 (1905), No. 3, pp. 258-262*).—The value of various fertilizers and mulches for cacao was studied in plat experiments for each of the years 1903 to 1905. The largest yield of wet cacao for the whole period was obtained on a plat mulched with grass and leaves. Next to this stood the plat fertilized with dried blood. Phosphates and potash, while increasing the yields by 25 to 30 per cent over no manure, were not as effective as either dried blood or simple mulching. It is believed that the method of manuring by means of a mulch of grass and brush is the proper course to adopt in Dominica for cacao.

Grafting cacao, J. JONES (*Agr. News [Barbados], 4 (1905), No. 94, p. 359*).—In grafting experiments it was found that the tiger cacao (*Theobroma bicolor*) was not suitable as a stock for the alligator cacao (*T. pentagona*). A good growth was secured when *T. pentagona* was grafted on *T. cacao*.

[Notes on varieties of chestnuts] (*Rural New Yorker, 65 (1905), No. 2920, p. 24, fig. 1*).—Notes are given on the yield and characteristics of 9 varieties of chestnuts under culture, and an account of the fruiting of several crossbred seedlings between Paragon and Japanese varieties now 6 years old.

These seedling trees are stated to be fairly intermediate between the parents, but the nuts and burs resemble the Japanese varieties. The nuts though large are of indifferent quality. The fruiting of seedling hybrids of Paragon and our native wild chestnuts is also noted. Crosses are also being made between chinquapin and Paragon, Ridgely, and many of the best Japanese varieties of chestnuts. It is hoped to blend the large size of the chestnut with the quality, prolificness, and early bearing habit of the chinquapin.

Systematic amelioration of grapes by the graft, A. JURIE (*Jardin, 19 (1905), No. 449, pp. 332, 333, figs. 2*).—A contribution to the subject with illustrations showing the amelioration in fruit production secured as a result of grafting and analyses showing changes in the composition of the wine produced.

Fertilizer experiments with grapes, H. SCHELLENBERG (*Landw. Jahrb. Schweiz, 19 (1905), No. 5, pp. 296-300*).—The results are given of fertilizer experiments with grapes carried on since 1891 at the horticultural experiment station in Wädensweil.

Plat 1 in the experiment was heavily fertilized during each of the years 1891 to 1904 with cattle manure. Plats 2 and 3 received during each year of the same period, except in 1894, 1,200 kg. of Thomas slag and 900 kg. of kainit per hectare. In addition plat 2 received each year liquid manure and plat 3, 450 kg. of nitrate of soda per hectare. Plat 4 received no Thomas slag or kainit, except in the year 1894.

The average yield of fruit during the 13 years of the experiment on the different plats was as follows: Plat 1, 5,547 kg.; plat 2, 5,485 kg.; plat 3, 5,430 kg.; and plat 4, 4,669 kg. The largest fruit on an average was secured on plat 3. The largest amount of second-class fruit, 9.5 per cent, was found on plat 1, and the smallest amount, 4.7 per cent, on plat 4. The wine produced was of practically like quality on each of the different plats.

Analyses of soils and the interpretation of the analytical results in the manuring of grapes, A. HUBERT (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 50, pp. 690–699, fig. 1*).—Chemical and physical analyses with descriptions of the methods employed are given for a number of different soils, together with a table showing the amounts of different kinds of nitrogenous, potassic, and phosphatic fertilizers to use on different classes of calcareous and noncalcareous soils.

Roses and how to grow them (*New York: Doubleday, Page & Co., 1905, pp. X+189, pls. 32, figs. 4*).—A popular manual containing directions for growing roses in the garden and under glass, and designed more especially for the use of the amateur. Much of the matter in the book has already appeared in magazine form.

Carnation breeding, C. W. WARD (*Gardening, 14 (1906), No. 321, pp. 129, 130, figs. 3*).—Brief historical notes on the carnation, with an account of the author's methods of breeding carnations by hybridization and selection.

It is stated that the annual value of the carnation product is between $5,000,000 and $6,000,000. A half interest in the variety Robert Craig, originated by the author, is stated to have brought $10,000. The bulk of the profitable varieties originated by the author trace back to the variety General Maceo, which was a cross between the English variety Winter Cheer and the American variety Meteor.

The chrysanthemum, A. HERRINGTON (*New York: Orange Judd Co., 1905, pp. VIII+160, pl. 1, figs. 32*).—Directions are given to professional growers and amateurs for the culture of chrysanthemums.

The main portion of the book is devoted to the production of large flowers such as are seen at exhibitions and in flower stores. The work takes up in systematic detail culture directions, beginning with the taking of the cuttings to the staging of the blooms. Chapters are also given on raising chrysanthemums from seed, hybridizing chrysanthemums, insect pests, and diseases.

A chemical study on the culture of chrysanthemums, A. HÉBERT and G. TRUFFAUT (*Bul. Soc. Chim. Paris, 3. ser., 33 (1905), No. 11, pp. 661–664*).—The authors cultivated the variety of chrysanthemums Madame Gustave-Henry out-of-doors in a rich soil without the addition of fertilizers, and analyzed the plants at 2 different stages of growth.

At the time of the first analysis, July 28, the plants had been growing 178 days and the first buttons were appearing. Sixty-four days later, during the first days in October, when the plants were in full bloom they were analyzed again. During the last 64 days of growth the plants took daily 3 times as much nitrogen, 3 times as much potash, 7 times as much phosphoric acid, 16 times as much lime, 20 times as much magnesia, and 5 times as much sulphuric acid as during the preceding 178 days.

It appears, therefore, that the most active growth of the chrysanthemum begins during August and it is at that time that special attention to watering and the use of soluble manures should begin. The analyses further show that for each part of nitrogen taken from the soil during the first period of vegetation there was withdrawn 1.42 parts of potash and 0.28 part of phosphoric acid, while during the second

period of vegetation there was withdrawn for each part of nitrogen 1.23 parts of potash and 0.47 part of phosphoric acid.

The usual fertilizers actually employed in the growing of chrysanthemums, such as night soil, are shown by analysis to contain 0.23 part of potash and 0.13 part of phosphoric acid for each part of nitrogen in the fertilizer. These proportions are not in harmony with the proportions as found by analysis of the plant and it is therefore believed that this accounts for the unfavorable results secured when this fertilizer is used alone for chrysanthemums.

A study of perennial garden phlox, C. J. HUNT (*Country Life Amer., 9 (1905), No. 1, pp. 66–69, figs. 11*).—Directions for the culture of phlox with lists of the best varieties to plant. The varieties noted are described in accordance with the recent color chart worked out by the French National Chrysanthemum Society.

The culture of fringed gentian, T. MURRAY (*Gard. Mag. [N. Y.], 2 (1905), No. 5, pp. 210–212, figs. 9*).—The author succeeded in growing fringed gentian (*Gentiana crinita*) as a garden plant. The plant appears to be a biennial, since seeds sown in the spring form only a rosette of leaves during that season and come into blossom the succeeding season. The seed is first sown in a cold frame on a bed of chopped sphagum moss and then transplanted to beds, handling it in much the same manner that poppy seedlings are handled.

New creations in plant life, W. S. HARWOOD (*New York and London: The Macmillan Co., 1905, pp. XIV+368, pls. 49*).—A popular and somewhat laudatory account of the work of Luther Burbank in the development of new varieties of fruits, nuts, vegetables, forage plants, and trees, with details of his methods of work and his theories in regard to the production of new varieties. Much of the matter contained has appeared in magazine form.

FORESTRY.

A handbook of the trees of California, ALICE EASTWOOD (*Occas. Papers Cal. Acad. Sci., 1905, No. 9, pp. 86, pls. 57*).—This is a concise popular manual of the trees of California. Such additional trees as grow in Washington, Oregon, and Arizona have also been included.

The book is arranged with 3 keys for the purpose of easy identification. In the first key the trees are arranged according to the leaves and in the second according to the fruits. The third is a regular scientific key based upon the botanical characteristics of flowers, fruits, and leaves. Illustrations are given of some portion of practically all of the California trees. A large proportion of these were prepared by Dr. A. Kellogg, one of the founders of the California Academy of Sciences.

Advice for forest planters in Oklahoma and adjacent regions, G. L. CLOTHIER (*U. S. Dept. Agr., Forest Serv. Bul. 65, pp. 46, pls. 4, figs. 7, map 1*).—A number of forest planting plans adapted for use in Oklahoma and portions of Indian Territory, Kansas, Colorado, Texas, and New Mexico are here presented. A planting plan is a detailed statement of all the operations necessary to establish and maintain a forest plantation upon a specific tract of land.

Report Irish Forestry Society (*Irish Forestry Soc. Ann. Rpt. 1904, pp. XII+84*).—Besides a general account of the work of the year by the secretary, J. S. Kerr, and a statement of accounts, the report contains a number of prize essays on the present condition and future prospect of forestry in various districts of Ireland.

Annual progress report of forestry administration in the Central, Oudh, and school circles of the United Provinces for the forest year 1903–4, L. MERCER, C. E. MURIEL, and H. JACKSON (*Ann. Rpt. Forest Admin. Cent., Oudh, and School Circles [India], 1903–4, pp. 174*).—This consists of the usual statements in regard to the constitution of the state forests, management, protection, sylviculture, exploitation, financial results, and administration for each of these provinces, with

appendixes showing in tabular detail the area of the different forests, cuttings, receipts, disbursements, etc.

Transplanting of bigtree seedlings, S. J. Flintham (*Forestry and Irrig., 11 (1905), No. 9, pp. 428–430*).—The author notes the results of successful experiments of ranger L. L. Davis, in charge of the General Grant National Park, in transplanting naturally sown Sequoia seedlings.

Most of the plants set out were from 4 to 18 in. in height and were from 2 to 3 years old. These had taproots often 1 to 2 or more feet long. Some 1-year-old plants which were 1 to 4 in. high were set out, but these did not succeed so well, as in the dry season the roots did not reach down to permanent moisture. The larger seedlings were quite hardy as to drought and frost even at elevations of 6,000 to 7,000 ft.

Seed bed fertilizer experiments on sandstone soils, Vater (*Tharand. Forstl. Jahrb., 55 (1905), No. 2, pp. 116–137*).—A detailed account is given of experiments to determine the effects of fertilizers in growing seedling spruces and pines.

In the first experiment the seed beds were located on sandstone soil of the second to third class. The fertilizers used were kainit, potassium chlorid, and potassium sulphate. Spruce seed was planted. The tabulated results show that the height growth of the seedlings was doubled and the mass growth trebled by the use of the fertilizer, the largest seedlings as regards height and weight being produced on the plat fertilized with kainit, closely followed by that fertilized with potassium chlorid. The potassium chlorid gave about 20 per cent better results as regards growth than the potassium sulphate.

Experiments with both pine and spruce seed on sandstone soil of the fourth quality gave results similar to those noted above as regards the beneficial effects of fertilizing seedlings. In one experiment the fertilizers were not applied until the seedlings were a year old. At the end of the following season they had made practically 40 per cent better growth than the unfertilized seedlings

Analyses are given of the different soils used and results included of some experiments by other investigators along similar lines.

The natural replacement of white pine on old fields in New England, S. N. Spring (*U. S. Dept. Agr., Bur. Forestry Bul. 63, pp. 32, pls. 4, map 1*).—This bulletin deals primarily with the life history of second-growth white pine on old fields and pastures in New England. Its object is to furnish such information about the characteristics of the white pine and the conditions governing its growth as will be of practical help to people in New England interested in the profitable growth of this timber.

At present merchantable stands of white pine in New England are being rapidly removed and commonly no seed trees are left to provide for future stands. Unless such seed trees are left the future extension of white pine forests in New England will be limited to occasional small groups, leaving much of the land to be occupied by inferior species. If seed trees are left it is thought probable that the number of stands of merchantable pine in New England will be greater 50 years hence than it is to-day and the quality of the timber better.

A white pine does not begin to bear full crops of cones until about 35 years of age. The heaviest seed years are from 5 to 7 years apart. Tests indicate that from 10 to 20 per cent of fresh white pine seed will not germinate. Seedlings grow very slowly but after that stage is past the growth is rapid for 50 to 60 years. The most rapid rate of growth occurs when the tree is from 30 to 40 years of age.

Tables are given showing the contents in cords of white pine trees of different diameters. A map is included which indicates where forests of various types of white pine in New England are found. Counts of seedlings 2 to 8 years old in typical white pine areas averaged 2,113 trees of all species per acre. Of these 80 per cent were white pine and 20 per cent birch and less valuable species. In regions of New

England where natural replacement can not be secured for lack of seed trees the planting of white pine is advised. A number of tables showing the composition of white pine stands at different periods of maturity are given. Pruning in young white pine forests is thought expensive and inadvisable.

In lumbering, it is recommended that 3 to 4 short-bolled and wind-firm seed trees be left per acre to insure the replacement of pine. The profits in second-growth white pine are shown to be as high as 11 per cent where the land is valued at not over $4 per acre, the annual outlay not over 12 cts. per acre, and the stumpage price of wood not less than $5 per cord. The highest rate of interest is secured if the trees are cut when from 35 to 45 years of age.

Loblolly pine in eastern Texas with special reference to the production of cross-ties, R. Zon (*U. S. Dept. Agr., Forest Serv. Bul. 64, pp. 53, pls. 4, figs. 2*).—The author made a study of the occurrence, manner of growth on different soils and in different mixtures, and of the uses of loblolly pine in eastern Texas.

Tables are given showing the composition of loblolly pine forests 35 to 40 years old on wet prairie, forests 24 and 60 years old on fairly well-drained light soils, mixed pine and hard wood forest 150 years old on poorly-drained soil, and 30 to 40 years old on well-drained fertile soil, and forests 10 to 29 years old on old fields. Normally this tree grows to a height of 90 to 110 ft. and has a diameter of 2 to 2.5 ft. It matures at 70 to 80 years of age. Its best growth is found on a deep, fairly loose sandy or light loamy moist soil. It is intolerant of shade during middle and later life. It begins seed production when about 30 years of age. Tables are given showing the rate of height and diameter growth of the tree on different soils and in different mixtures.

About 300,000,000 ft. of loblolly pine lumber is annually turned out by the mills of Texas. The lumber is usually sold under the name of short-leaf pine. The large proportion of sapwood which loblolly pine usually contains makes it desirable to kiln dry it immediately after it is sawed to avoid the attack of a fungus which stains it blue. The untreated timber readily rots in exposed situations, but when treated with preservatives outlives either the short-leaf or long-leaf pine.

The volume yield of loblolly pine at different stages of growth is tabulated. By present methods of cutting pole ties, the author shows that from 54 to 71 per cent of the timber goes into slabs and excessive dimensions and is thus wasted. Tie cutters prefer trees 10 to 15 in. in diameter or between 30 and 50 years of age. The author shows that this is the period of most rapid growth of the trees and from the standpoint of profits and economy only trees 15 to 17 in. through should be used. About 80 per cent of the loblolly pine now standing in Texas is of tie size. In discussing a loblolly pine forest as an investment, the author shows a probable return of about 5 per cent on a 40-year investment.

Cultivation and commercial fertilizers for stunted pine stands of the Würtemberg Black Forest, F. Hofmann (*Allg. Forst u. Jagd Ztg., 81 (1905), Sept., pp. 297–307, dgm. 1*).—In a pine forest 20 to 25 years of age which had made very poor growth because of poor soil, extensive development of weeds and grass, etc., an experiment was made to determine the value of cultivation.

Thomas slag, ammonia, superphosphate, and kainit were also used experimentally on young plantations of pine and spruce. The experiments were begun in 1900 and the results secured up to 1904 are discussed. Cultivation alone proved sufficient to thoroughly rejuvenate and start into good growth the older forest of pine. Among the fertilizers tested Thomas slag proved especially effective. General suggestions based on the author's observations are given for forestry practices on poor soils.

Spruce seed sown broadcast, A. Knechtel (*Forestry and Irrig., 11 (1905), No. 9, pp. 430, 431*).—It has been commonly observed that evergreen trees spring up readily in poplar groves. The belief has become prevalent, therefore, that spruce finds in such places good conditions for reproduction.

In order to test this matter about a bushel of native spruce seed was sown in 1903 in such a grove. The poplars ranged in diameter from 4 to 10 in. The seed was scattered on fallen leaves, decaying wood, and on all spots where the mineral soil was exposed. About 8 qt. of seed was used per acre. An examination of the area in July, 1904, showed that where mineral soil had been exposed and on rotten wood the little trees were doing well and in many places 4 or 5 trees were found per square foot. Where the leaves were thick, however, the trees were scarce.

It is believed that over the whole ground they were sufficiently numerous to make a satisfactory evergreen forest if they all continue to grow. A further examination in August, 1905, showed that the trees were still alive and about as numerous as the preceding year.

The influence of different degrees of thinning on the stem form of spruce, M. KUNZE (*Tharand. Forstl. Jahrb., 55 (1905), No. 2, pp. 138–150*).—Diameter measurements of the boles of 228 trees selected from a section of a forest which had been (a) lightly thinned and (b) medium thinned, and of 187 trees selected from a section (c) strongly thinned, are given in an extended series of tables. The trees were about 83 years old at the time of the measurements and many in the strongly thinned section had been broken by a storm. The measurements are given without conclusions.

The maple sugar industry, W. F. FOX and W. F. HUBBARD (*U. S. Dept. Agr., Bur. Forestry Bul. 59, pp. 1–45, pls. 8, figs. 10*).—The history of the maple sugar industry is briefly outlined and data given on its present status.

It appears that about seven-eighths of the maple product sold to-day is spurious. Since 1850 there has been a gradual decrease both in quantity of sugar and in the sugar-producing area of the country. The various sugar maple trees are briefly described and suggestions given regarding the improvement of mature dense maple groves for sugar-making purposes, and of open groves, dense young groves, and thickets. An ordinary mature thrifty maple will produce about 12 gal. of sap or 3 lbs. of sugar per season. The sap is stated to contain on an average about 3 per cent of sugar.

Directions are given for the manufacture of sugar and sirup, including the tapping of the trees, gathering of the sap and its evaporation, with the estimated cost of the various operations. A grove in which the ground is well shaded and which each season carries a heavy carpet of leaves is thought best for sugar crops, since the trees are less exposed to undesirable extremes of temperature during the sap season.

Germinating Para rubber seeds (*Agr. News [Barbados], 4 (1905), No. 90, p. 293*).—Platforms were erected about 4 ft. from the ground and over these old sacking was stretched. They were then covered over with a little powdered charcoal and the seeds placed on this and covered with more sacking and the whole kept damp by occasional watering. As the seeds sprouted they were removed and potted. Seventy-five per cent of a case of seeds received from Peradeniya germinated after this treatment, notwithstanding they had been delayed over 3 weeks in transit.

The cultivation and preparation of Para rubber, W. H. JOHNSON (*London: Crosby Lockwood & Son, 1904, pp. XII+99, pls. 5, fig. 1*).—Directions are given for the culture of Para rubber, including methods of tapping, preparation of rubber from the latex, yield of Para rubber from cultivated trees in Ceylon, Malay Peninsula, and the Gold Coast, and the commercial value of the oil in hevia seeds.

The rubber industry in Peru, J. M. VON HASSEL (*La industria gomera en el Peru. Lima: Opinión Nacional, 1905, pp. 29, figs. 4*).—This is a popular pamphlet on the rubber industry in Peru, with notes on the species grown, distribution, climatology of different sections, cultural methods, and the future of the industry.

Report on rubber in the Gold Coast, W. H. JOHNSON (*Gold Coast, W. Africa: Dept. Agr., 1905, pp. 15*).—Statistics are given of the rubber production of the Gold

Coast for the years 1880 to 1903, inclusive, and of the results of experiments in growing exotic rubbers.

The quantity of rubber exported from the Gold Coast has decreased from the maximum production in 1898 of 5,984,984 lbs. to 2,258,981 lbs. in 1903. A number of species of foreign rubbers have been grown in the botanic gardens of Aburi. Of these, *Hevea brasiliensis* has given the best results, considerably surpassing in yield and quality of rubber the native *Funtumia elastica*.

The experiments indicate that trees of *F. elastica* should not be tapped before they are 9 years old. Trees of *H. brasiliensis*, 10 years old, yielded on an average 1 lb. ¾ oz. per tree, while the largest yield from trees of *F. elastica*, 7 to 9 years old, was 4 oz. Not only does *H. brasiliensis* grow faster than *F. elastica* and yield a larger amount of rubber of better quality, but it is also freer from insect pests and fungus attacks.

Investigations of kickxia caoutchouc from Cameroons (*Tropenpflanzer, 9 (1905), No. 10, p. 590*).—Analysis of the caoutchouc from this plant showed 3.5 per cent water, 87.2 per cent best quality caoutchouc, 0.5 per cent poor quality caoutchouc; 7.1 per cent caoutchouc resin, and 1.7 sand, etc.

Hand book of timber preservation, S. M. Rowe (*Chicago: Pettibone, Sawtell & Co., 1904, souvenir ed., rev., pp. 203+IV, pls. 20, figs. 58*).—The methods, appliances, and materials used for preserving timber on a large scale are discussed at length for various woods, many illustrations being given of the appliances used in preparing the material and applying the preservatives.

A new impregnation treatment for wood, G. Janka (*Centbl. Gesam. Forstw., 31 (1905), No. 10, pp. 397–401*).—The Rüping system of timber preservation is described.

In the case of railroad ties, the ties are first submitted to a pressure of 5 atmospheres. While still under this pressure they are immersed in coal tar oil and the pressure gradually raised according to the character of the timber to a maximum of 15 atmospheres. The oil is then drawn off and the release of pressure facilitates the driving out of much of the oil that entered the wood.

It is claimed that where 36 kg. were formerly necessary for impregnating a sleeper having 0.11 cu. meter content but 5.5 kg. are required by the Rüping system. It is estimated that the German railroads use annually about 200,000 tons of coal tar oil as a preservative for railroad ties, and that under the Rüping system but 30,000 tons will be required.

Turning sawmill waste into water-white turpentine (*Fla. Times-Union, 1905, Oct. 27, p. 6*).—A description is given of a successful commercial plant for extracting water-white turpentine from sawdust by means of retorts into which steam is injected. It is claimed that from 5 to 15 gal. of water-white turpentine can be obtained by this process in less than an hour from 2 tons of sawdust.

DISEASES OF PLANTS.

Fungus diseases in India in 1903, E. J. Butler (*Ztschr. Pflanzenkrank., 15 (1905), No. 1, pp. 44–48*).—A condensed account is given of the parasitic fungi observed on a number of economic plants in India during 1903. These are grouped according to host plants into diseases of cereals and fodder plants, vegetables, sugar cane, tea and coffee, palms, forest trees, etc.

Among the principal diseases of cereals the author notes the occurrence of a number of species of rusts and smuts, and for the prevention of the latter he suggests soaking the seed preliminary to sowing in a ½ per cent solution of copper sulphate.

A wilt disease of pigeon pea, due to the fungus *Neocosmospora vasinfecta*, is reported as quite common wherever this plant is cultivated. The early and late blight of potatoes are prevalent, and a disease of eggplants, due to an undetermined species of Colletotrichum, is reported.

Among the diseases of sugar cane the most serious is said to be due to *Colletotrichum falcatum*, which causes the red rot. The smut (*Ustilago sacchari*) and the brown spot of the leaves due to *Cercospora longipes* are reported as having been observed, but so far *Trichosphæria sacchari* and *Thielaviopsis ethacethicus* have not been reported.

A number of serious pests of the tea and coffee plants are reported, among them the alga (*Cephaleuros virescens*), the gray blight of tea (*Pestalozzia guepini*), *Cercospora theæ*, thread blight (*Stilbum nanum*), a root disease due to *Diplodia* sp., and the rust (*Hemileia vastatrix*).

Among the diseases of forest trees the spike disease of sandalwood, which is said to resemble the peach yellows of this country, is briefly described, and notes are given on a number of other species of considerable importance.

Some investigations of plant diseases (*Rpt. Expt. Farms. Cent. Prov. [India], 1903-4, p. 17*).—Notes are given on a number of diseases, among them the smut of cereals, for the prevention of which the author recommends immersing the seed in a solution of copper sulphate for 5 minutes as a most satisfactory treatment for use in India. A disease of pigeon pea (*Cajanus indicus*) is briefly described, the disease being some form of wilt. It is thought probable that the disease is due to some soil fungus. Wheat rusts are briefly commented upon and a report given of a test of 115 varieties for rust resistance.

Frost blisters and their origin, F. NOACK (*Ztschr. Pflanzenkrank., 15 (1905), No. 1, pp. 29-43*).—The blisters noticed on the leaves of a number of plants are described and explanations offered as to their origin. The first noticed were on the leaves of alfalfa after a period of low temperature when the thermometer registered —3° C. The action of freezing in withdrawing the water from the cells into the intercellular spaces, where ice masses are formed, is described, and it is thought probable that the elasticity of the underlying parenchyma resulted in its separation from the epidermis. The intrinsic differences in plants in regard to injury by frost are discussed, and the localization of injury, influence of structure, etc., are commented upon.

Internal infection of the wheat grain by rust, H. L. BOLLEY and F. J. PRITCHARD (*Science, n. ser., 22 (1905), No. 559, pp. 343, 344*).—It has been generally assumed that rusts of cereals grow only in the leaves and stems, but recent observations at the North Dakota Station have convinced the authors of the probability that rust of wheat may sometimes persist perennially. Field experiments have indicated that the rust either attacks wheat from the soil in some form, or it may in some manner be communicated through the seed. This latter hypothesis suggests the mycoplasm theory of Ericksson, but the authors think they have a more rational explanation than that offered by Professor Ericksson.

Observations made on numerous samples of wheat harvested from the badly rusted crop of 1904 allow the authors to make the statement that wheat grains from badly rusted plants are very often and in some strains are quite uniformly internally affected by wheat rust filaments to such an extent that both summer and winter spores are produced beneath the bran layer of the grain. In some samples of rust-infected wheat as high as 30 per cent of all grains examined were infected with the stem rust (*Puccinia graminis*), and spore beds bearing both uredospores and teleutospores were found located beneath the bran layer of the grain, usually about the embryo wheat plant. These spots bearing the spores are most commonly located immediately at the germ end, causing a blackened or blighted appearance, but are often found on other portions of the berry, especially along the margin of the grooves. Grains thus affected were found to germinate as freely as other wheat grains.

The observations thus far made have not definitely shown that wheat rust attacks may come in this direct manner from the seed, but if later experiments confirm this

possible mode of propagation the necessity for proper seed selection and grading in farm practice will become very evident.

Symbiosis in Lolium, A. NESTLER (*Sitzber. K. Akad. Wiss.* [*Vienna*], *Math. Naturw. Kl.*, *113* (*1904*), *No. 8–9, pp. 529–546, pl. 1; abs. in Bot. Centbl.*, *98* (*1905*), *No. 18, pp. 451, 452*).—A brief review of literature relating to the fungus occurring in *Lolium temulentum*, *L. perenne*, and other species is given, after which the author describes investigations with the two above-named species, experiments on the pure cultures of the fungus from the darnel, and a peculiar malformation that is possibly due to the fungus.

The fungus is said to be found only in the stems during the growing season and never in the leaves or roots, and there seems to be a true symbiosis between the host and the parasite. The author could not find any evidence to show that the grain of the infested plants was any better developed than those free from the fungus. A greater proportion of seeds of *L. temulentum* is affected by the fungus than of *L. perenne*, only 28 per cent of the latter being found to contain the fungus hyphæ. It is thought that the symbiosis between the fungus and the perennial rye grass is not as yet so well established as is the case with the darnel.

A description is given of a curious growth in many seedlings of darnel. The growing stem seems in some way to be caught in the leaf sheath, causing it to form a loop, which finally bursts through and resumes its upright growth. That this is wholly due to the presence of the fungus is questioned.

A contribution to the biology of ergots, R. STÄGER (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *14* (*1905*), *No. 1, pp. 25–32*).—In a previous publication (E. S. R., 16, p. 985) attention was called to inoculation experiments with various species of Claviceps, in which biological races were shown for the fungus. The identity of several species which had been hitherto considered distinct was pointed out, but the identity of species occurring on *Brachypodium sylvaticum* and on *Milium effusum* was not fully determined.

In the present paper the same species of Claviceps is said to infest each of the above species of grass, as was shown by numerous inoculation experiments, and the author believes that this species is probably a biological form of the ergot occurring on rye. It is believed probable that in nature this species is able to infest through its biological forms both of the species of grass enumerated above. There seems to be a kind of heterœcism between the different forms. On Milium the ergot forms conidia and very rarely normal sclerotia, while upon Brachypodium it forms conidia and well-developed sclerotia.

Black scab of potatoes, J. W. EASTHAM (*Year Book Col. Agr. and Hort. Holmes Chapel, 1904, pp. 11–13, pl. 1*).—A description is given of the black scab of potatoes, due to *Chrysophlyctis endobiotica*. This disease was first noticed and described on potatoes grown in Hungary in 1896, and was first recorded in Great Britain in 1900. Since that time it has spread to various parts of Great Britain, in some cases causing considerable loss.

The disease must not be confounded with the true scab, which forms rusty patches caused by a corky thickening of the epidermis of the potato. In the black scab the potato puts out various excrescences, which are of irregular growth, wrinkled, and wartlike. Not only the tubers, but the underground stems and the bases of the stems above ground are subject to attack by this fungus.

Investigations have shown that the fungus is capable of withstanding the action of lime, frost, etc., when in a resting stage, and that its attacks are most severe on light dry soils.

As preventive treatment, the author suggests the destruction of all diseased potatoes by burning, or feeding them after being thoroughly cooked. Winter plowing or the use of lime in autumn or winter seems to be without effect, although the application of lime in May has apparently some influence in retarding the disease.

The thorough use of sulphur on and about the seed potatoes is also suggested as a means of partial control.

It is stated that the investigations indicate the possibility of the fungus remaining in the soil for more than 6 years.

Methods of spraying cucumbers and melons, W. A. ORTON and W. D. GARRISON (*South Carolina Sta. Bul. 116, pp. 36, pls. 4, figs. 2*).—This bulletin gives an account of experiments carried on in cooperation between the South Carolina Station and the Bureau of Plant Industry of this Department.

In 1903 a severe epidemic of cucumber powdery mildew prevailed in the vicinity of Charleston, S. C., and in the fall of that year and the spring of 1904 and of 1905 experiments were conducted for its control. The authors describe the experiments in detail, and the practical conclusions as well as descriptions of the fungi are given, which are identical with those in Farmers' Bulletin No. 231 of this Department (E. S. R., 17, p. 672).

The inspection and disinfection of cane cuttings, N. A. COBB (*Hawaiian Sugar Planters' Sta., Div. Path. and Physiol. Bul. 1, 2. ed., pp. 35 + VI, pls. 8*).—The purpose of this bulletin is to call attention to the fungus diseases of cane that gain entrance through the cuttings, and to offer suggestions for their prevention. The author recommends selection of growing cane, inspection at time of harvesting, rejection of all diseased or suspected canes, care in making the cuttings, and treatment with fungicides, particularly with Bordeaux mixture. Several plans for treating cane in large quantities are described.

Preliminary notes on root disease of sugar cane in Hawaii, L. LEWTON-BRAIN (*Hawaiian Sugar Planters' Sta., Div. Path. and Physiol. Bul. 2, pp. 39, figs. 12*).—The author describes a number of diseases of sugar cane, the most important of which is the root disease. This disease, which is of fungus origin, has caused the abandonment of the cultivation of Lahaina and Rose Bamboo canes in certain localities.

The first symptoms of the disease are observed in the appearance of the plants, which seem to be suffering as from drought. The leaves stand upright, are rolled together, turn yellow, and gradually become dry. The lower leaf sheaths become matted together about the base of the stem, and a white fungus mycelium is found among them.

In Hawaii the root disease is also said to affect germination. The fungus (*Marasmius sacchari*) is essentially a soil fungus and is able to live as a saprophyte on dead organic matter in the soil, especially about the base of the cane stools.

The treatment recommended is the planting of resistant varieties, cultivation and liming the soil, destruction of diseased material, and when severe the abandonment of cane cultivation for a time. Ratooning is not considered advisable where the disease is prevalent.

The third report on gumming of the sugar cane, N. A. COBB (*Hawaiian Sugar Planters' Sta., Div. Path. and Physiol. Bul. 3, pp. 46, figs. 12*).—In continuation of the publications of the author while in Australia, notes are given on the gumming of sugar cane, which is of bacterial origin.

The author reviews some of the previous publications regarding this disease and describes recent investigations as to its origin, spread, etc. In conclusion he states that the disease, which is a very distinct one, was first discovered in Australia and is due to *Bacterium vascularum*. While the course of the disease is somewhat slow, it often destroys plants and may cause serious losses to the sugar industry. The disease may be recognized by the appearance of a yellowish gum or slime on the ends of freshly cut stalks. This first appears at the ends of the fibers, but finally runs together into large drops.

The disease is particularly connected with the vascular bundles, but may extend into the parenchymatous tissue, especially at the base of the arrow, where it causes a

kind of top rot characterized by the presence of much slime in cavities near the top of the stalk. Different varieties of cane vary in their susceptibility to disease, some being practically immune. It is said to be of easy control through the selection of sound cuttings and the use of resistant varieties. Attention is called to the liability of its transfer from one country to another through the medium of slightly diseased cuttings.

The red string of the sugar cane, R. G. SMITH (*Proc. Linn. Soc. N. S. Wales, 29 (1904), pt. 3, pp. 449-459, pls. 3*).—The presence of red-colored fibrovascular bundles in sugar cane is said to be not at all uncommon, the phenomenon appearing to accompany several diseases of the cane, as well as in some instances occurring in canes that are apparently healthy.

The author gives a description of a form investigated, to which the name red string is given. This was observed in canes otherwise healthy, as well as in plants affected with gummosis. Portions showing the red coloration were cut out of cane and transferred to culture media, from which the author obtained a mold and several species of bacteria. The mold was found under certain conditions to produce the reddish color, but did not produce any slime, while the bacteria produced the characteristic slime. Of the 3 species of bacteria isolated only one was found capable of producing the crimson red gum in the vessels of the cane. This organism was studied and is described under the name *Bacillus pseudarabinus*, n. sp.

The red mold was also studied and is described at some length. The author was unable to associate it with any hitherto described species, but from his characterization he thinks it will be possible for other investigators to recognize it.

The crown-gall and hairy-root diseases of the apple tree, G. G. HEDGCOCK (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 90, pt. 2, pp. 7, pls. 3*).—A preliminary report is given of investigations on the crown-gall and hairy-root diseases of the apple tree, for the purpose of calling the attention of apple growers to the different diseases and to interest them in the collection of data regarding the predisposition of varieties to these diseases.

The author's investigations have resulted in separating what was previously called the apple crown gall into two diseases. The disease now designated as crown gall is a callous-like gall growth following wounds on some portion of the root system of the tree and which rarely occurs above the ground on parts of the trunk or limbs.

The malady now called hairy-root disease is evidently the same as the one first named in New York State Station Bulletin 191 (E. S. R., 13, p. 148) and is characterized both in seedlings and in grafted or budded trees by a stunted root system, accompanied with an excessive production of small fibrous roots, often originating in clusters from the main or tap root. Galls often occur in connection with the hairy root, but these are the results of wounds rather than a form of the disease.

The apple crown gall is of two types. In one a hard callus is formed on grafted trees at the union of the root and scion, or at any other point of the root system where wounds occur, and the results of extensive inoculation with this type have failed to prove that this disease is of a contagious nature. The second type is a soft form more common on seedlings, occurring rarely on grafted trees. These softer galls resemble those of the raspberry and peach, in that they are soft and often rot off, but it is not certain that they are replaced the following year by a new growth, nor is there any proof that they are of a contagious nature.

Nurserymen are advised to give careful attention to the selection of seedlings for grafting and budding, rejecting all that show tufted or hairy roots, as these will develop into hairy-rooted trees with a very deficient root system. So far as the investigations go, this disease is not contagious. It is hoped that in the near future practical means for reducing the percentage of trees affected with these diseases will be known.

A new apple rot, B. O. LONGYEAR (*Colorado Sta. Bul. 105, pp. 12, pls. 4*).—There has been recently observed in Colorado a widely distributed decay of apples and pears which seems to be due to an undescribed species of Alternaria. The fungus was first reported at the station in 1902, when it was recognized by W. Paddock, and some inoculation experiments were made in 1904.

So far as studied, the fungus attacks only the fruit of the apple, its most common point of attack being the blossom end. The affected fruits show dark purplish brown, slightly sunken areas at the base of the sepals. This area may remain small and scarcely noticeable for a long time, but when the fruit is placed in storage it is apt to increase in extent until the fruit is entirely decayed. In some cases, although not usually, the blossom end of the apple is cracked open and the adjoining tissue is more or less discolored.

The rotting caused by the fungus is not so rapid as that caused by many of the soft rot fungi, and it seems probable that fruit affected by the Alternaria in many cases succumbs to some of the more rapidly acting rots which seem to follow it.

In many cases there is no noticeable evidence of the presence of the fungus until the apple is cut through, when the core cavity is found to be blackened or discolored. In the majority of such cases the parchment-like lining of the seed cavity is the only part to show the discoloration. This appears brownish or blackened and the seeds are usually covered with a dark colored growth of the mycelium. The invasion of the core by the fungus appears to be most common among certain varieties, the Winesap being especially subject to this form of attack. The reason for this is found in the peculiar structural character of the fruit. Varieties having deep calyx tubes seem to be more subject to this form of attack.

In the case of the pear the fungus has been found on fruit, leaves, and young sprouts. The fruit is liable to be attacked at almost any point. On the leaves the fungus produces brown spots of considerable size.

The microscopic characters of the fungus are described at considerable length, and, although not extensively investigated, it appears from infections that the fungus gains entrance to the fruit through the withered stamens and stigmas which remain at the blossom end of the fruit. The principal source of infection in the spring appears to be diseased fruits, which remain in the orchard, either lying on the ground or sometimes clinging to the fruit spurs. The fungus also hibernates on the twigs and fruit spurs, as was observed during the past season. Wounds in the fruit caused by the larvæ of the codling moth frequently give entrance to the Alternaria.

Numerous cultures have been made of the fungus, and inoculation from these resulted in the formation of decayed areas in 2 or 3 days. The only fruit besides the pear and apple which was inoculated with the fungus was the tomato, but in this case it made no progress.

As previously noted, some varieties of apple are more subject to disease than others, and among the pears the Keiffer is the only one which has shown liability to attack.

No attempt has been made to estimate the amount of injury due to this new rot, but it is not believed to be very destructive as compared with some of the fruit rots which attack the apple and pear in more humid regions.

In the absence of experimental work for the control of the Alternaria rot the author suggests clean culture, the use of fungicides, and the rejection of those varieties which are particularly susceptible to the attacks of the fungus.

California vine or Anaheim disease—its cause and nature, H. HOOPS (*How to make grape culture profitable in California. Wrights, Cal.: Author, 1904, pp. 3–8*).—The author has been making a special study of the California vine disease and claims that its prime cause is the great change in the moisture content of soils from wet in the spring to dry during the latter part of the summer.

If the soils were always wet or always dry there would be no disease. In order to prove this claim the author irrigated vines of susceptible varieties during the early

part of June by soaking the ground thoroughly, after which the water was shut off and the ground became exceedingly dry. Some of the vines showed the attack of disease the first summer, while others did not show it until the second. All vines in the same vineyard that were not irrigated remained healthy.

The author discusses the resistance of varieties to this disease, and suggests combating it by the use of resistant stocks.

Black rot and its treatment, A. PRUNET (*Prog. Agr. et Vit. (Ed. l'Est), 26(1905), No. 17, pp. 509–518*).—It is claimed that by destroying all dried grapes that remain on the vines in the fall and careful attention to the periods when the black-rot fungus appears, it will not be necessary to extensively spray vineyards every season. If these suggestions are rigorously followed over large areas, the author believes that black rot and the destruction it causes could be almost wholly eliminated.

Treatment of mildew, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. l'Est), 26(1905), No. 17, pp. 505–507*).—Formulas are given for the preparation of basic and neutral solutions of Bordeaux mixture and Burgundy mixture, with suggestions for the use of these fungicides in dry and wet regions where mildew alone is to be expected or where black rot also occurs.

The proper application of copper fungicides, L. DEGRULLY (*Prog. Agr. et. Vit. (Ed. l'Est), 26 (1905), No. 16, pp. 477, 478*).—For combating black rot of grapes the author strongly recommends the use of dilute solutions of copper. It is said that 10 hectoliters of Bordeaux mixture containing 1 per cent of copper gives better results than 5 hectoliters of a 2 per cent solution.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

The destruction of birds by the elements, 1903–4, E. H. FORBUSH (*Agr. of Mass., 1903, pp. 457–503, pl. 1, figs. 3*).—During 1903, the spring, especially the month of May, was drier than had been reported for Massachusetts for the previous 30 years. This led to a scarcity of water and insects and was followed by extensive forest and grass fires. The month of June following showed an unusual rainfall and cold weather, while the winter of 1903–4 was one of unusual severity. The drought and forest fires of spring combined with the heavy rains and floods of June and the severe weather of winter destroyed the food and the eggs and nests of various species of birds and the adult birds themselves in large numbers.

Detailed notes are given from reports received from correspondents regarding the effects of these severe climatic conditions in destroying birds. Suggestions are made regarding nesting boxes and other means of protecting birds.

The quail, the best insect and weed exterminator, E. HARRIS (*Toronto: W. Briggs, 1905, pp. 11*).—The habits and food of the quail are discussed in considerable detail with especial reference to the value of this bird in destroying injurious insects and weed seeds.

Fruit-eating birds, C. FRENCH, JR. (*Jour. Dept. Agr. Victoria, 3 (1905), No. 5, pp. 364–370*).—Notes are given on the distribution, breeding season, and feeding habits of a considerable number of birds which feed upon fruit in New South Wales.

Report of committee on gypsy moth, insects, and birds, A. PRATT ET AL. (*Agr. of Mass., 1903, pp. 220–225, pl. 1*).—During 1903 climatic conditions were unfavorable to the spread of insects. Numerous complaints were made, however, on the injuries due to gypsy moth. The moth was found present in large numbers in Medford, Malden, and Melrose. Since the pest occurs abundantly along railroads and about depots, it is suggested that railroad transportation may ultimately be responsible for distributing the insect very widely.

Some miscellaneous results of the work of the Bureau of Entomology, VIII (*U. S. Dept. Agr., Bur. Ent. Bul. 54, pp. 99, pls. 4, figs. 20*).—*The sugar cane beetle, E. S. G. Titus* (pp. 7–18).—*Ligyrus rugiceps* injures cane before the tips appear

above ground and about 1 to 2 in. above the base of the stalks. Corn is similarly attacked. The life history of the pest is outlined and notes are given on its enemies. In preventing injury infested fields should not be planted until spring, rubbish should be cleared up, and corn should not follow cane. The pest may be reduced by hand picking.

Report on a Mexican cotton pest, the "conchuela," A. W. Morrill (pp. 18–34).—*Pentatoma ligata* was studied in Durango, Mexico. A technical description of the pest is given, with notes on the food plants. Adults feed on the bolls, stem, and leaves. The number of eggs ranges from 20 to 40 and the period of incubation is about 8 days. The bugs may be hand picked or brushed into pans containing oil.

The sugar-beet crown borer, E. S. G. Titus (pp. 34–40).—*Hulstea undulatella* was found injuring sugar beets in Washington, Oregon, and California. The larvæ tunnel from the base of the leaves down through the root. The insect is described and notes are given on its distribution. The pest may be partly controlled by thorough cultivation of the soil about the time when the larvæ are mature.

The dock false-worm, F. H. Chittenden and E. S. G. Titus (pp. 40–43).—*Taxonus nigrisoma* feeds on dock and sugar beets. The pest may best be controlled by eradicating dock and knotweed in the vicinity of beet fields.

The pepper weevil, C. M. Walker (pp. 43–48).—*Anthonomus æneotinctus* is reported as injuring sweet peppers in Texas since 1903. The peppers become infested immediately after the blossoms fall. The life history of the pest is outlined in considerable detail and notes are given on its feeding habits. Arsenicals are probably of little use against this insect. All infested peppers should be gathered and destroyed.

Cold storage for cowpeas, J. W. T. Duvel (pp. 49–54).—Experiments in combating weevils in cowpeas showed that cowpeas may be kept free from weevils by maintaining them at a temperature of 32–34°. This process does not injure the seed and may be applied for 15 to 25 cts. per bushel per season. The storage room should be kept dry.

The larger canna leaf-roller, F. H. Chittenden (pp. 54–58).—*Calpodes ethlius* attacks canna in South Carolina and Alabama. The pest is described, with notes on its life history and distribution. It may be readily controlled by hand picking from infested leaves.

Grasshopper conditions in Nebraska, northeastern Colorado, Wyoming, Montana, and western Kansas during the summer of 1904, L. Bruner (pp. 60–64).—A brief account is given of injuries due to various species of grasshoppers, including *Melanoplus differentialis, M. bivittatus, M. atlanis, Camnula pellucida*, etc.

The bulletin also includes short articles on *Galerucella nymphææ*, Colorado potato beetle in Great Britain, hydrocyanic-acid gas for cigarette beetle, Fuller's rose beetle, *Castnia licus* in sugar cane, *Rhizobius lophanthæ*, mosquitoes, *Anticarsia gemmatilis*, cabbage worm, *Monocesta coryli*, plum gouger, *Epilachna borealis*, hydrocyanic-acid gas for bed bug, red spider on cotton, etc.

Thirty-fifth annual report of the Entomological Society of Ontario, 1904 (*Ann. Rpt. Ent. Soc. Ontario, 35 (1904), pp. 112, pls. 2, figs. 61*).—At the forty-first annual meeting of the society held at London, Ontario, October 26 and 27, 1904, a number of papers were read and reports submitted, some of which are of sufficient economic importance to be briefly noted in this connection.

Brief reports were made on the insects of the year in different districts of Ontario, attention being called to some of the more conspicuous insect injuries noted during the year. Reports were also received from the various branch societies. Insects and weeds in the Northwest Territory were discussed by T. N. Willing. Box elder was greatly damaged by the larvæ of *Hibernia tiliaria* and quaking aspen by *Clisiocampa fragilis*. The beet webworm was also observed in considerable abundance.

W. Lochhead discussed a number of insect problems. During the season plum and apple curculios were abundant and *Phoxopteris nubeculana* caused considerable

damage to apples. Notes are also given on various garden insects; borers on the hollyhock, Aquilegia, and dahlia; spring-tails in primroses; household pests, bot flies, and other injurious insects. The author made a test of two formulas of lime-sulphur wash, the first containing 25 lbs. lime, 20 lbs. sulphur, and 12½ lbs. sal soda per barrel of water, and the second containing 30 lbs. lime, 15 lbs. sulphur, and 5 lbs. caustic soda per barrel of water. After careful application of these two forms of wash it was found that excellent results were obtained with both and that little difference could be seen in their effectiveness. Attention is also called to the recent progress in entomological study including the importation of parasitic and predaceous enemies, the development of effective insecticides, study of malaria, etc.

The distribution of insects in the Great Basin was discussed by H. F. Wickham, and insects injurious to orchard crops in 1904 were considered by J. Fletcher. The latter called attention to the comparative scarcity of the pea weevil, the attacks of asparagus beetles, cabbage aphis, cutworms, beet-leaf miner, cabbage worms, carrot fly, San José scale, New York plum scale, squash bug, and insects on house plants. The same author briefly reviewed some of the entomological work of 1904.

The report of the society also contains a list of insects captured during the year; notes on basswood insects by A. Gibson, and on the columbine borer (*Papaipema purpurifascia*) by A. Gibson; a list of insects collected at night by J. D. Evans; spinning methods of the polyphemus moth by J. W. Cockle; insect names by J. B. Williams, notes on the insects of 1904 by C. Stevenson; insects affecting the oak and food habits of certain hymenoptera by T. W. Fyles; an elementary study of insects by W. Lochhead, and the pear-tree psylla by G. E. Fisher.

Leaf hoppers and their natural enemies, R. C. L. PERKINS (*Hawaiian Sugar Planters' Sta. Div. Ent. Bul. 1, pts. 5, pp. 159–181, pls. 3; 6, pp. 187–205, pls. 3; 7, pp. 205–238, pls. 4; 8, pp. 239–267, pls. 3*).—Earwigs occasionally do damage to garden plants, hops, etc. Some of these are also insectivorous. Among the eight species of earwigs in Hawaii five have been observed in cane fields and two seem to be of some importance in destroying leaf hoppers. These species are *Chelisoches morio* and *Anisolabis annulipes*. These are described in all their stages. Notes are also given on *Chrysopa microphya*, *Baccha siphanticida*, and *B. monobia*. The last two species belong to the family Syrphidæ and are described as new.

The family Mymaridæ contains a number of parasitic insects which live upon various orders of insects. One of the most important species as a parasite of leaf hoppers is *Paranagrus optabilis*. Various other new species of this family are described, and notes and descriptions are also presented of new species of Proctotrupoidea.

Mention is made of a number of enemies of leaf hoppers found among Orthoptera, Coleoptera, and Hemiptera. The most important predaceous insect discussed is the grasshopper *Xiphidium varipenne*, which is described as a new species. This species is largely insectivorous and feeds during all its stages on various insects. The young grasshoppers were observed catching and eating nymphs of the leaf hoppers. An examination of the stomach contents of these grasshoppers showed that 21 per cent of them contained insect remains. Notes are also given on *X. latifrons*, *Callineda testudinaria*, *Coccinella repanda*, *Verania frenata*, and a number of Hemiptera.

Notes are given on three other families of parasites, Encyrtidæ, Eulophidæ, and Trichogrammidæ. Particular attention is given to the classification of the parasites of these families with descriptions of new genera and species. A brief bibliography is added and a table given of the species discussed.

Combating scale insects, TRABUT (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 10, pp. 215–217*).—Particular attention is given to the control of scale insects on orange trees. While good results may be obtained by the use of various forms of petroleum emulsions, these remedies are considered difficult to prepare and apply. Lime-sulphur-salt wash is recommended as a reliable insecticide for scale insects on

oranges. Good results have also been obtained from the use of a mixture containing 5 kg. sulphate of iron and 5 kg. lime per 100 liters of water.

May flies and midges of New York, J. G. NEEDHAM, K. J. MORTON, and O. A. JOHANNSEN (*N. Y. State Mus. Bul. 86, pp. 352, pls. 37, figs. 18*).—This constitutes the third report on aquatic insects based on investigations conducted under the direction of the State entomologist.

A special account is presented of the summer food of the bull frog as observed at Saranac Lake. The insect and plant food of the bull frog is classified in a tabular form according to its systematic position. Special notes are also given on the different kinds of food found in the stomach of the frogs examined.

The greater part of the bulletin is occupied with a biological account of Ephemeridæ, Hydroptilidæ, and nematocerous Diptera. The habits and life history of many of the species are considered. Analytical tables are presented for the ready identification of the species and many new species are described. A bibliography relating to the subject is also given.

Report of the entomologist, C. B. SIMPSON (*Transvaal Dept. Agr. Ann. Rpt. 1904, pp. 345–352*).—A brief account is given of the equipment of the entomological department, legislation regarding injurious insects, orchard fumigation, beekeeping, locust destruction, *Novius cardinalis*, and insects injurious to man, plants, and stored products.

The monthly bulletin of the division of zoology, H. A. SURFACE (*Penn. Dept. Agr., Mo. Bul. Div. Zool., 3 (1905), Nos. 2, pp. 33–64; 3, pp. 65–96; 4, pp. 97–128; 5, pp. 129–160, pls. 2, figs. 5*).—Brief discussions are presented of plant lice, cabbage root-worm, scale insects, nursery inspection, flies, fumigation of buildings, fall webworm, preservation of birds, canker worms, Hessian fly, etc. A spraying calendar is also given.

Cooperative spraying experiments, M. V. SLINGERLAND (*New York Cornell Sta. Bul. 235, pp. 81–98, figs. 10*).—A series of cooperative spraying experiments for different purposes have been carried out with various fruit men with the result that while no new discoveries have been thereby secured the experiments have served as object lessons for neighboring fruit growers.

In spraying for plum curculio some of the fruit men reported no beneficial results on account of the fact that the curculio did not appear in large numbers. Others, however, found benefit from the use of arsenate of lead at the rate of 2½ lbs. per 50 gal. of water. Three applications were made, just before blooming, just after the petals fell, and again about a week later. The author recommends that arsenate of lead should be applied at least twice at the rate of 3 or 4 lbs. in 50 gal. of water or in Bordeaux mixture. The New York fruit growers appear to consider it unwise to cultivate cherry orchards late enough to affect the plum curculio. One fruit grower sprayed for the quince curculio at the rate of 2½ lbs. of arsenate of lead per 50 gal. of water. Two applications were made and the results were favorable to the continued use of this method.

Further experiments in spraying for the control of the grape root-worm indicate that this pest may be satisfactorily kept in check when grapevines are sprayed with arsenate of lead at the rate of 8 lbs. per 100 gal. of water. The total expense of spraying is about $3.25 per acre, and an examination of grapevines showed that in many cases the insects were entirely eradicated. The leaves on sprayed vines remained green and healthy long after untreated vineyards began to look brown. It is believed that two applications of arsenate of lead will be necessary, one as soon as the beetles appear and the other about a week or 10 days later.

A comparative test was made in the preparation of Bordeaux mixture from ordinary line and "new process" lime. It appears that some dealers sell air slaked lime for prepared limes. It should be remembered that in order to make a satisfactory Bor-

deaux mixture it is necessary that the lime be capable of combining chemically with the copper sulphate.

One satisfactory method of making Bordeaux mixture was found to be to have three barrels emptying by a faucet into a common trough connecting with the spray tank. In one barrel 15 lbs. of copper sulphate is dissolved in 50 gal. of water, in the second from 18 to 20 lbs. "new process" lime is dissolved in the same manner, while the third barrel is filled with clear water. After the contents of the barrels have been thoroughly agitated all three barrels are opened and the materials flow together into the spray tank. In these experiments it was found that prepared limes cost somewhat more than stone lime but they possess an advantage in that all the material could be used, while this is not true with ordinary stone lime in barrels.

The insect pests of cotton, H. A. BALLOU (*West Indian Bul., 6 (1905), No. 2, pp. 123–129*).—In this article the author discusses the habits, life history, and the medial measures against cotton worm, red maggot, *Eriophyes gossypii*, and other cotton pests.

The cotton red spider, E. S. G. TITUS (*U. S. Dept. Agr., Bur. Ent. Circ. 65, pp. 5, figs. 2*).—*Tetranychus gloveri* causes injury to the cotton plant by feeding chiefly on the underside of the leaves, but occasionally attacks all parts of the plant. While under the leaves the mites are protected by a loose web.

The life history and means of distribution of this pest are briefly indicated. Several species of predaceous insects prey upon the mites and their eggs. The cultural methods of control of the pest include rotation of crops, destruction of cotton stalks, deep plowing, and burning and destruction of weeds and rubbish. For spraying infested plantations the author recommends the use of sulphur, lime-sulphur wash, lye-sulphur wash, or kerosene emulsion.

Insect enemies of tobacco in Hawaii, D. L. VAN DINE (*Hawaii Sta. Bul. 10, pp. 16, figs. 6*).—Notes are given on the habits, life history, and means of combating the more important insect pests of tobacco in Hawaii, including cutworms, tobacco flea beetle, *Phthorimæa operculella*, false budworm, tobacco hornworm, *Adoretus umbrosus*, and cigarette beetle. Notes are given on the occurrence of these pests and remedies suggested which are suited to Hawaiian conditions.

Review of the insect pests affecting sugar cane, H. A. BALLOU (*West Indian Bul., 6 (1905), No. 1, pp. 37–47*).—In this article a concise summary is given of known facts regarding some of the most injurious pests of sugar cane, including *Diatræa saccharalis*, *Sphenophorus sericeus*, *Diaprepes abbreviatus*, *Castnia licus*, and other pests. Recommendations were made regarding the most effective methods for controlling these insects.

The joint-worm, F. M. WEBSTER (*U. S. Dept. Agr., Bur. Ent. Circ. 66, pp. 5, figs. 5*).—This pest occurred in great numbers in 1905, particularly in Indiana and Virginia. The insect is described in its different stages to assist in its recognition. No direct and effective remedies are known. Cultural methods for use in reducing the ravages of the pest include the use of fertilizers, thorough cultivation, burning stubble, and rotation of crops.

The cottony grass scale, EDITH M. PATCH (*Maine Sta. Bul. 121, pp. 169–180, pls. 2*).—The cottony grass scale (*Eriopeltis festucæ*) did not attract much attention until 1904, when it occurred in large numbers and caused extensive injury to grass lands.

It was noticed in 1905 that the insect had spread very rapidly in localities where infestation was observed during the previous year. The number of eggs in each sac is 600 to 700, and under favorable conditions it is apparent that the pest may multiply rapidly. The insect is held in check to some extent by unfavorable weather conditions, the prevalence of rust upon grasses, predaceous insects, overcrowding, and parasites. Since the insect passes the winter in the egg stage attached to grass blades above ground, it is a simple matter to control it by burning infested grass

land. In one instance where this was tested in the spring of 1905 the scale insect was almost entirely destroyed by a single treatment.

Detailed notes are given on the life history of the insect. It seems to attack chiefly June grass and red top. A list is given of the parasites bred from the pest and brief notes are given on the literature relating to this subject.

Control of codling moth, T. W. Kirk (*New Zeal. Dept. Agr., Divs. Biol. and Hort. Bul. 6, pp. 7*).—Tests were made of the efficiency of spraying trees with Paris green, resin solution, a combination of arsenic and soda, arsenate of lead, and kerosene emulsion in the control of codling moth. The amount of clean fruit after the application of these insecticides varies from 81 to 89 per cent.

Descriptions of three species of fruit flies, T. Broun (*New Zeal. Dept. Agr., Divs. Biol. and Hort. Bul. 4, pp. 6, pl. 1*).—The author describes as new with notes on their habits and life history *Tephrites xanthodes*, *Lonchæa splendida*, and *Drosophila ampelophila*.

A mite disease of grapevines, F. Bœuf (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 10, pp. 217–221*).—Considerable injury has been done to grapevines in Tunis by *Cœpophagus echinopus*. This mite attacks the roots of grapevines and ultimately causes the death of the plants. Ordinarily the pest feeds upon dead wood and detritus, but may attack sick grapevines which have a low resisting power.

The application of bisulphid of carbon to the soil around infested vines has been found to yield excellent results. In some cases single treatment with 300 kg. per hectare was sufficient but, as a rule, 2 treatments requiring 400 kg. per hectare were more satisfactory.

Insects attacking cacao in the West Indies, H. A. Ballou (*West Indian Bul., 6 (1905), No. 1, pp. 94–98*).—Notes are given on the habits, life history, and means of combating a number of insect pests of cacao, including *Steirastoma depressum*, *Physopus rubrocincta*, etc.

The cottony maple scale, J. G. Sanders (*U. S. Dept. Agr., Bur. Ent. Circ. 64, pp. 6, figs. 4*).—The economic importance of the cottony maple scale is discussed with notes on its food plants, habits, life history, parasites, and predaceous enemies.

In some cases the natural enemies of the scale are quite effective in reducing its numbers. Occasionally, however, the pest multiplies to such an extent that artificial remedies must be applied. For this purpose infested trees may be trimmed in the fall and sprayed with kerosene emulsion or whale-oil soap. In the summer a weak kerosene emulsion (not more than 10 or 12 per cent) may be used in cases of excessive infestation.

The bronze birch borer, M. V. Slingerland (*New York Cornell Sta. Bul. 234, pp. 65–78, figs. 9*).—*Agrilus anxius* is reported as having greatly injured or destroyed European white birch on the Cornell campus and elsewhere.

The presence of this insect may be recognized from the hole through which it enters into the bark, by the dying of the top branches of the tree, and by the ridges which develop over the burrows of the insect on the branches. The pest is described in detail with notes on its life history and on previous records of its occurrence. This insect is widely distributed throughout northern United States and Canada. It attacks all kinds of birch trees and occasionally willows.

The bronze birch borer hibernates as a full-grown grub and appears in the spring, after which it lays its eggs probably in the crevices of the bark. There is one brood annually. The pest is preyed upon by woodpeckers and also by at least one parasite, *Phasgonophora sulcata*. There appears to be no way of preventing the borer from laying its eggs upon the birch and the only practical way of checking its ravages is promptly to cut and burn infested trees during the winter or at least by May 1.

Ants, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 16 (1905), No. 9, pp. 861–866, pl. 1*).—The appearance and habits of various species of native Australian ants are

discussed with reference to their economic importance and methods of destroying the injurious species.

Introduction of bees to Australia, A. GALE (*Agr. Gaz. N. S. Wales, 16 (1905), No. 9, pp. 848–852*).—An historical statement is presented regarding the first importations of bees to Australia and the difficulties which the bee raisers experienced in combating foul brood and other diseases of bees.

Bee culture, I. HOPKINS (*New Zeal. Dept. Agr., Dirs. Biol. and Hort. Bul. 5, pp. 30, pls. 5, figs. 2*).—A general account is presented of the use of comb foundation, method of ripening extracted honey, the symptoms and treatment of foul brood, the treatment of bee moth, and the relation of apiculture to various lines of agriculture.

The nutrition of the bee, T. CHERRY (*Jour. Dept. Agr. Victoria, 3 (1905), No. 6, pp. 469–474*).—Attention is called to the importance of proper food for the development of larval bees. The composition of pollen from different plants varies greatly, particularly with regard to the amount of protein. An adequate supply of protein is considered quite necessary to the development of a vigorous colony, and where any doubt is felt regarding the composition of pollen or other bee food a supply of rye flour should be provided. Rye flour is apparently better than wheat flour, which is likely to become caked in a hard mass.

FOODS—HUMAN NUTRITION.

The relation of population to food products, Y. GUYOT (*Le rapport de la population et des subsistances. Nancy: Berger-Levrault & Co., 1905, pp. 24*).—On the basis of statistics, the author discusses meat and wheat production in proportion to the population, and believes that for the last 70 years the production has not kept pace with the increase in population. Intensive agriculture is, therefore, considered a necessity.

The seaweed industries of Japan and the utilization of seaweeds in the United States, H. M. SMITH (*Extr. from Bul. Bur. Fisheries [U. S.], 24 (1904), pp. 133–181, pls. 5, figs. 33*).—A number of marine plants are used in Japan as food, for fertilizer, and in other ways. The character and extent of the seaweed industry is discussed and the different seaweeds described in detail. The author also describes the Irish moss industry of Massachusetts and discusses other seaweeds which are used to a greater or less extent in the United States, and suggests ways in which the use of seaweeds may be increased.

Report of the Commissary-General to the Secretary of War, J. F. WESTON (*Rpt. Commis. Gen. [U. S. Army], 1905, pp. 21*).—In addition to the usual data regarding the resources and expenditures of the Commissary-General, some information is given regarding the army training school for bakers and cooks at Fort Riley, Kans. The testing of flour, rations in the Philippines, and related topics, and tests of methods of cooking without fire are very briefly alluded to.

Food legislation, W. D. BIGELOW (*N. Y. State Libr. Bul. 97, pp. k1–k3*).—In a review of food legislation enacted in 1904 the author states that no general food laws were enacted during the year and that new food laws of even limited scope were few. The modifications of existing laws are briefly spoken of. In the author's opinion they were not sufficiently numerous or sufficiently important in their bearing to call for an extended notice.

Review of the literature of composition, analysis, and adulteration of foods for the year 1904, A. J. J. VANDEVELDE and M. HENSEVAL (*Separate from Bul. Serv. Surveill. Fabric. et Com. Denrées Aliment., 1905, pp. 104*).—In this, the fifth annual volume, titles are reported of articles on analytical methods, apparatus, water, food products, preservatives, spices, and related topics. Notes explaining the char-

acter of the articles cited supplement the bibliographical data in a number of cases. For earlier work see E. S. R., 16, p. 999.

Pure food (*Rpt. Bur. Agr., Labor and Indus. Mont., 9 (1904), pp. 262-272*).—The Montana statutes which relate to pure food are summarized and the fact pointed out that the State has no pure-food law. Some data regarding the extent of adulteration in the State and an article on the importance of milk and meat inspection to the public health by T. J. Sullivan are also included. Sixty-five per cent of the foods and vinegars examined were found to be adulterated or sophisticated.

Food preservatives, their advantages and proper use. The practical versus the theoretical side of the pure-food problem, R. G. ECCLES (*New York: D. Van Nostrand Co., 1905, pp. VI+202*).—The author believes that used in a reasonable way there is less danger from the ordinary food preservatives than from bacteria and other micro-organisms whose growth and development they hinder. The majority of his opinions and deductions favoring the use of preservatives are not in accord with the consensus of opinion of food chemists. The volume contains an introduction by E. W. Duckwall.

Coloring matters for foodstuffs and methods for their detection, W. G. BERRY (*U. S. Dept. Agr., Bur. Chem. Circ. 25, pp. 40*).—The introduction states that this summary of data on the classification and detection of coloring matters, which was presented as a report to the Association of Official Agricultural Chemists, is regarded as preliminary and is published in the hope of eliciting suggestions and criticisms. The classification of colors includes coal-tar color lakes, natural colors of vegetable and animal origin, organic lakes, mineral pigments, and coloring compounds.

The use of coal-tar colors in food products, H. LIEBER (*New York: H. Lieber & Co., 1904, pp. 150; rev. in Jour. Amer. Chem. Soc., 27 (1905), No. 10, p. 1364*).—The main portion of this volume is taken up with an account of physiological experiments with dogs and rabbits on the effects of coal-tar colors given hypodermically and in food. It is apparently very largely a translation of T. Weyl's *Die Theerfarben.*

A summary is also given of the laws of different countries relating to the use of coal-tar colors in foods. The author urges that dealers in colors intended for food products be forced to sell only colors which have been demonstrated to be harmless and that manufacturers of food products should exercise more care in selecting colors.

The composition of West Indian foods as shown by analyses made in the laboratory of the Colonial Museum at Haarlem, M. GRESHOFF ET AL. (*Bul. Kolon. Mus. Haarlem, 1904, No. 30, Sup.; 1905, No. 33, Sup.*).—Continuing earlier work (E. S. R., 15, p. 495) analyses are reported of 150 food products obtained from Suriname and Curaçao.

Some of the materials analysed were corn meal of local production, rice, yams, taro, yautia or tannia, banana flour, breadfruit flour, colocasia flour, cactus flour made from the stems of a variety of Cereus, cassava, breadfruit, mango, passion flower fruit, mammea, guava, papaya, spondia, memordica, banana, pineapple, rose apple (*Eugenia jambosa*), sapodilla, tamarinds, beans, peanuts, carcoyar nut, and various other fruits and nuts, as well as vegetables, meat, fish, etc.

Analyses of some Martinique food plants, P. AMMANN (*Agr. Prat. Pays Chauds, 5 (1905), No. 32, pp. 439, 440*).—Analyses of several samples of yautia and yam are reported.

The value of wheat for bread-making purposes. Experiments and analyses, F. F. BRUYNING, Jr. (*Separate from Arch. Teyler, 2. ser., 9 (1905), pt. 3-4, pp. 217, pls. 4*).—An extended series of investigations is reported on the composition and bread-making value of a number of varieties of wheat of special importance in the Low Countries. The experimental and analytical methods followed are described and a large amount of data is summarized regarding the work of other investigators.

A study of durum wheat, F. A. NORTON (*Jour. Amer. Chem. Soc., 27 (1905), No. 8, pp. 922–934*).—The investigations reported with durum wheat were carried on at the South Dakota Station, and the results have been in part noted from another publication (E. S. R., 17, p. 269).

Durum wheat products are noticeably sweet. Analyses showed that Kubanka durum wheat contained 3.26 per cent sugar and Blue Stem 1.42 per cent, invert sugar and soluble starch being absent in both wheats. Approximately 1.25 per cent dextrin was also found in the Kubanka wheat.

In the discussion on macaroni making the author states, on the basis of personal observation, that most of the American macaroni is made from bread wheat, yet he is convinced that the durum wheats are greatly superior for the manufacture of macaroni and other edible pastes. He also considers durum wheats well adapted for the manufacture of breakfast foods.

"Of the different varieties which have been employed for trial at the South Dakota Experiment Station and Highmore substation, Kubanka, Pererodka, Beloturka, Arnautka, and Yellow Gharnovka have given considerably the best results."

The nutritive value of different sorts of flour, P. FAUVEL (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), pp. 1424–1427*).—The experiments with man reported were made with white flour, whole-wheat flour, and brown army bread.

The whole-wheat flour bread did not offer any advantage over the brown bread. It did not furnish more digestible phosphoric acid, while it diminished the excretion of urea, produced an appreciable quantity of purin, irritated the intestine, and diminished the assimilation of other nutrients. The army bread gave better results than the white bread.

The assimilation of whole-wheat bread, P. FAUVEL (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 5, pp. 252–254*).—Continuing work noted above the author studied the comparative value of whole wheat and white bread. In spite of its high protein content the whole-wheat bread caused a diminution of the urea excreted amounting to 2.4 gm. per day on an average, while it increased the excretion of xantho bodies and uric acid and the proportion of these bodies to urea. Although whole-wheat bread contains a large amount of phosphoric acid it did not increase the urinary excretion of this constituent.

The formation of acid in mixtures of flour and water under the influence of bran, G. GEISENDÖRFER (*Inaug. Diss., Univ. Würzburg, 1904; abs. in Hyg. Rundschau, 15 (1905), No. 20, p. 1054*).—Mixed with water rye flour becomes more acid than wheat flour and coarse flour more acid than fine. When mixed with water under similar conditions more acid is formed from bran than from flour and from flour containing bran than from flour without it. In this acid formation the phosphorus compounds in the bran are of importance and very probably the bacteria which are also present.

Testing wheat flour for commercial purposes, H. SNYDER (*Jour. Amer. Chem. Soc., 27 (1905), No. 9, pp. 1068–1074*).—Physical and chemical tests, it is the author's belief, should both be used in testing the quality of wheat flour. For another discussion of this topic by the author see E. S. R., 17, p. 113.

The use of talc as a coating or polishing material for pearl barley, rice, millet, and dried peas, H. MATTHES and F. MÜLLER (*Ztschr. Öffentl. Chem., 11 (1905), pp. 76–82; abs. in Analyst, 30 (1905), No. 351, p. 206*).—Of 25 samples of pearl barley examined, 16 were free from talc, 5 contained less than 0.2 per cent, and the remainder 0.2 to 0.63 per cent.

It was found that by shaking the grains with talc more than 2 per cent would adhere to the barley. The presence of talc can be detected by shaking the grains of barley with water, allowing the mixture to settle, and examining under a microscope. The amount present may be ascertained by igniting 25 gm. of the grain,

extracting the ash with hydrochloric acid to remove magnesium compounds, etc., naturally present, and analyzing the residue. Talc was also found in a number of samples of rice, millet, and peas.

A soy bean bread containing no starch, BARDET (*Bul. Gén. Thér. Méd. et Chirurg., 149 (1905), p. 181; abs. in Biochem. Centbl., 3 (1905), No. 19-20, p. 642*).—An analysis of a soy bean bread is reported.

Studies of canned meat, E. CARLINFANTI and A. MANETTI (*Arch. Farmacol. Sper. e Sci. Aff., 4 (1905), No. 7-8, pp. 345-358*).—Detailed analyses of new and old samples of canned meat are reported and discussed. The preserved meat was provided by the Italian minister of war.

Liebig's meat extract, I. F. KUTSCHER (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, pp. 528-537; Zentbl. Physiol., 19 (1905), No. 15, pp. 504-508*).—According to the author's conclusions meat extract does not have a uniform composition, and bodies which are occasionally found in it should not be considered as necessary constituents of muscular tissue. The bodies which he identified were ignotin, methylguanidin, carnomuscarin, neosin, novain, and oblitin.

Chinese duck egg yolk, H. LÜHRIG (*Ber. Chem. Untersuch. Amt. Chemnitz, 1904, p. 20; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 4, pp. 255, 256*).—Chinese duck egg yolk alone and mixed with the yolk of hens' eggs is imported into Europe in large quantities for use in the manufacture of noodles and other egg pastes. A sample of such duck egg yolk which the author examined contained 7.18 per cent fat and 1.285 per cent total phosphoric acid, of which 0.906 gm. was soluble in boiling alcohol and 0.379 gm. insoluble.

The spoiling of eggs, H. SCHLEGEL (*Ber. Untersuch. Anst. Nurnberg, 1904, pp. 9, 10; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 4, p. 255*).—It was found that good eggs did not spoil or "rot" when kept in intimate c tact with rotten eggs for 8 days at a temperature of 25° C. They did, however, take up the offensive smell of the spoiled eggs. This investigation was undertaken to determine the possibility of fresh eggs spoiling quickly when contaminated with rotten eggs.

Studies of spoiled canned vegetables, J. BELSER (*Arch. Hyg., 54 (1905), No. 2, pp. 107-148*).—The results of bacteriological studies of spoiled canned goods, of the chemical composition of the gas present in swelled cans, the gas pressure in such cans, the temperature required for sterilization, and related topics with special reference to improvement in methods of canning.

Hop sprouts as vegetables, G. W. ROOSEVELT (*Mo. Consular Rpts. [U. S.], 1905, No. 297, p. 59*).—The author states that young tender hop sprouts are sold in the Brussels markets in large quantities in the spring. Large quantities are also canned or bottled. For the early market, hop sprouts are forced but are not considered as tender and succulent as sprouts cut from plants which have been covered with earth during the winter.

To what constituent does coffee owe its stimulating properties? M. GEISER (*Arch. Expt. Path. u. Pharmakol., 53 (1904), No. 2, p. 112; abs. in Zentbl. Physiol., 19 (1905), No. 15, p. 517*).—According to the investigations reported, coffee owes its stimulating properties solely to the caffein present.

The composition of Java cane-sugar molasses, H. C. PRINSEN GEERLIGS (*Meded. Proefstat. Suikerriet West-Java, 1905, No. 85, pp. 42*).—Analyses of 77 samples of cane-sugar molasses of various sorts are reported and discussed with special reference to the comparative merits of different methods of sugar making. The author notes that centrifugal and drip molasses have practically the same average composition, and that in general the composition of the molasses is determined by that of the sirup before crystallization.

The adulteration of maple products, H. W. WILEY (*U. S. Dept. Agr., Bur. Forestry Bul. 59, pp. 47-54*).—The author points out that glucose is the chief adulterant of maple sugar, and that its use is fraudulent rather than harmful, since

glucose is known to be a wholesome product. The characteristics of pure and adulterated maple products are discussed and standards quoted.

Attention is drawn to the fact that the exact chemical nature of the flavoring material present in the maple products is not known, "though it is probably an ether or aldehyde possessing a high boiling point. . . . Detection of this flavoring matter by chemical means has, up to the present time, baffled the skill of the chemist, and for this reason the taste of the expert has been relied upon almost solely to distinguish between the genuine and the adulterated article in cases where the adulterant is cane sugar. Thus it is apparent that pure cane sugar can be utilized to a certain extent in the adulteration of maple products without certainty of detection.

"The flavoring matters appear to reside chiefly in the molasses or semiliquid parts of the maple product, and for this reason the refining of maple sugar to a perfectly dry, white, crystalline mass would deprive it of the chief of its properties upon which its high market value depends." The use of hickory extract for flavoring artificial or adulterated maple products is spoken of.

Maple sirup and sugar, T. MACFARLANE (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 102, pp. 18*).—Only 24.3 per cent of samples of maple sugar and sirup, collected before the maple-sugar season in 1905, were found to be genuine. In the case of samples collected after the maple-sugar season 63.4 per cent were found to be genuine.

Concerning the dextrin found in honey from Coniferæ, P. WOLFF (*Inaug. Diss., München, 1904; abs. in Zentbl. Stoffwechsel u. Verdau. Krank., 6* (*1905*), *No. 21, p. 495*).—The author concludes that the dextrin of coniferous honey is not a mixture of dextrin and sugar, but a definite body having the character of achroodextrin and that it differs in the honey from different varieties of Coniferæ. Malic acid, in his opinion, must be regarded as a normal characteristic of natural honey.

Laboratory experiments on the digestibility of dried milk, D. SOMMERVILLE (*Pub. Health* [*London*], *18* (*1905*), *No. 1, pp. 40–45*).—From artificial digestion experiments with dried milk the author concludes that with respect to both protein and fat it is more digestible than fresh milk, the investigation being undertaken with special reference to the use of dried milk in infant feeding.

Dried milk, "in respect of its reaction to rennet, to peptic digestion, to pancreatic digestion, and in respect of the condition of its fat, . . . approaches more nearly to human milk than does fresh milk, if the . . . experiments [reported] convey any truthful information; and, although they must considerably differ from the corresponding natural digestions, still they possess a certain value when carried out . . . [in connection with suitable tests for purposes of comparison]. . . .

"Probably the chief reason for the difference in the tolerance of the 2 forms of fat [cream and butter] is, that in cream the fat is present in the form of globules of neutral fat, which have to be split into glycerin and fatty acids to prepare the fat for absorption. Butter, on the other hand, containing, as it does, nearly 7 per cent of fatty acids—butyric, caproic, etc.—is already partially prepared for absorption. The absorption of butter fat is therefore more rapid and complete than the absorption of cream fat. These differences have their application in the feeding of both dyspeptic adults and children.

"Where it is necessary to add fat in quantity to a diet, it is better perhaps, in most cases, to serve it in the form of butter than to add large quantities of cream to milk, as is so often done, since the retarding influence of cream on the secretion of gastric juice will interfere with the digestion of the proteids of the milk." It is also pointed out that the dried-milk preparation possesses the advantage of sterility and constant composition.

The importance of inorganic salts in the metabolism of man and animals, A. HIRSCHLER and P. TERRAY (*Math. u. Naturw. Ber. Ungarn, 20* (*1902*), *pp. 145–238*).—In this report, published in 1905, the authors hold that increasing knowledge

of the physiology and pathology of cell life emphasizes the importance of the mineral constituents in general and of the phosphates and other phosphorus compounds in particular. Previous work upon the metabolism of phosphorus, calcium, and magnesium is reviewed in some detail, the estimates of different writers as to the amounts of these elements contained in the food and eliminated by the kidneys and the intestines being given.

Experiments upon 2 growing dogs showed that the normal storage of nitrogen during growth was accompanied by a storage of phosphorus and calcium, and that the storage of nitrogen and rate of growth were increased by feeding eggs in place of a part of the ordinary food. This is held to substantiate the view that eggs should be added to the diet of children at as early an age as possible.

Observations upon the metabolism of nitrogen, phosphorus, calcium, and magnesium in a case of *Endoarteritis chronica deformans* are also recorded.

The liberation of energy in fasting and fed animals as shown by the respiratory quotient, A. CHAUVEAU (*Ann. Sci. Agron., 2. ser., 10 (1905), I, No. 2, pp. 191–208*).—The investigations reported led the author to conclude that energy is more slowly liberated in the body when fasting than when fed.

A study of the metabolism of a vegetarian, J. M. SWAN (*Amer. Jour. Med. Sci., 129 (1905), pp. 1059–1065; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 8, Rev., p. 482*).—On a vegetarian diet the nitrogen consumption was 9.3 gm. per day and the amount excreted in the urine 9.8 gm. The conclusion was reached that the diet followed was not calculated to produce a properly nourished and mentally and bodily active individual.

The influence of the temperature of food upon the stomach, J. MUELLER (*Ztschr. Diätet. u. Phys. Ther., 8 (1905), No. 11; abs. in Brit. Med. Jour., 1905, No. 2339, Epit., pp. 67, 68*).—A series of experiments were undertaken to ascertain to what extent the stomach secretions, its motility, and power of resorption are affected by the temperature at which food is taken. Under ordinary circumstances the temperature of food as eaten varies from 5 to 60° C.

The principal conclusions reached were that the stomach has the power of modifying the temperature of ingested food so that it is equal to that of the body. This change of temperature is effected by the withdrawal of heat in the case of hot foods or raising the temperature in the case of cold foods, and also by the action of the secretions of the stomach. The stomach is emptied more rapidly when the fluid taken has the same temperature as the body. Cold drinks which contain alcohol cause an active secretion by the stomach, while water alone has no such effect.

Relation of creatinin excretion to variations in diet, W. KOCH (*Amer. Jour. Physiol., 15 (1905), No. 1, pp. 15–29*).—In connection with an investigation of the excretion of creatinin the effect of lecithin and kephalin in the diet was studied with man and a dog.

The author calculates that a molecule of lecithin would supply methyl groups for 3 molecules of creatinin, or approximately 8 gm. of lecithin would yield 3.39 gm. of creatinin and that 1 molecule of kephalin would supply its 1 methyl group for the formation of 1 molecule of creatinin, or 8 gm. of kephalin would yield approximately 1.13 gm. of creatinin. The deductions which were drawn follow:

"Creatinin is excreted with remarkable constancy by the dog as well as by man. The extreme daily variations in the case of the dog do not affect the final average. The excretion per kilo body weight for 24 hours is very nearly the same for both (24–26 mg. for the dog; 26–30 mg. for man).

"Under ordinary conditions of diet, the methyl groups of the lecithin and kephalin ingested can all be accounted for by the methyl groups of the creatinin excreted. With an excess of lecithin and kephalin this is not the case, although the creatinin undeniably increased. This increase is due to the lecithin and kephalin of the and not to some other constituent.

"Creatinin is probably a better index of methyl metabolism than of the lecithin and kephalin metabolized, although under ordinary conditions the two seem closely related.

"Further experiments will have to determine if physiological activity is capable of influencing this metabolism to a greater extent than the presence of an excess of methyl groups in the form of lecithin and kephalin.

"If creatinin bears the relation to methyl metabolism suggested in the above paper, it should be possible to demonstrate the presence of creatin in every tissue having such a metabolism. The presence of creatin in striated muscle is a well-known fact. I have also found it in the heart muscle and in the testicle, and am continuing the investigation of other tissues."

The peptic cleavage products of the wheat proteid artolin, H. Hayashi (*Arch. Expt. Path. u. Pharmakol., 52 (1904), p. 289; abs. in Biochem. Centbl., 3 (1905), No. 19–20, pp. 599, 600*).—Gentle digestion gave 2 artroses and on further action of the ferment the artroses yielded parartrose and metartrose. By still further action of the ferment the metartrose was unchanged while the parartrose yielded heteroartrose, protoartrose, and deuteroartrose, as well as artolin antipeptone, a body free from sulphur.

Experiments on carbon-dioxid production when lying down and standing up, K. E. Widlund (*Skand. Arch. Physiol., 17 (1905), No. 3–5, pp. 290–293*).—The experiments reported led to the conclusion that when standing with the muscles relaxed there is no increase in carbon-dioxid production, and hence the amount of muscular effort put forth is very small. When, however, the subject stands with tense muscles there is a relatively large increase in carbon-dioxid production, indicating that thus maintaining the position involves considerable muscular work.

The constant presence, the quantity, and origin of uric acid in the feces of man in health, F. Galdi (*Policlin., Sez. Med., 12, No. 3–4; abs. in Zentbl. Stoffwechsel u. Verdau. Krank., 6 (1905), No. 19, p. 445*).—According to the author, uric acid is a constant constituent of the feces of man in health, the amount being independent of the quantity and weight of the feces. Part of this uric acid comes from the nuclei of lymph cells, part from the blood and from cell nuclei taken in with the food, and a part from the intestinal secretions.

ANIMAL PRODUCTION.

Dried beets as a sugar-yielding feeding stuff, A. Muntz and A. C. Girard (*Ann. Sci. Agron., 2. ser., 10 (1905), I, Nos. 1, pp. 154–160; 2, pp. 161–190*).—Data on sugar and sugar-yielding materials with special reference to sugar beets and sugar-beet products and on apparatus and methods for drying sugar beets are summarized, and studies are reported on the composition of dried beets and their value as a feeding stuff for horses.

When used as a substitute for mixed grain in amounts up to 3.6 kg. per head per day satisfactory results were obtained as shown by a comparison with the gains made by horses fed a standard ration of mixed grain and hay. In the authors' opinion, the sugar-beet industry may be profitably extended by the utilization of this crop as a feeding stuff.

Feeding stuffs, F. T. Holbrook and E. J. Russell (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 169, 170*).—Miscellaneous feeding stuffs, including oil cakes, dried grains, oat offal, boiled cabbage stalks, and molascuit were analyzed.

The percentage composition of boiled cabbage stalks was water 84.4, protein 4.1, crude fiber 2.7, and sand 0.7 per cent. "These had been prepared on the erroneous idea that boiling an indigestible body will make it digestible. Boiling may soften the food and reduce the work of the teeth, but it does not enable the digestive fluids to act more vigorously on the boiled than on the unboiled substances."

The oil content of cotton seed of different sorts grown in Central Asia, D. TSCHERNEWSKY (*Zhur. Russ. Fiz. Khim. Obshch., 34 (1902), pp. 503, 504; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, p. 561*).—The seed of American cotton examined contained 23.46 per cent oil; the American upland seed, 21.19 per cent; Egyptian seed, 23.35 per cent; Bokhara seed, sample No. 1, 17.15 per cent, and sample No. 2, 17.75 per cent.

Profitable stock feeding, H. R. SMITH (*Lincoln, Nebr.: Author, 1906, pp. XII+413, figs. 71*).—The author has summarized and discussed a large amount of data regarding the feeding, care, and management of farm animals, the results of experiment station investigations having been drawn upon, as well as the experience of practical stock raisers.

It has been the author's purpose to present the results of investigations and experience in such a way that they may be of use to the student and investigator, as well as to the stock raiser, and with this end in view he has summarized and discussed the data rather than cited individual experiments. As a whole, the volume constitutes a useful summary of the general principles of stock raising, milk production, and the feeding, care, and management of beef cattle, sheep, pigs, farm poultry, and horses. The section on poultry was contributed by Miss M. L. Smith.

Steer-feeding experiment, VII, 1903-4, O. ERF, R. J. KINZER, and G. C. WHEELER (*Kansas Sta. Bul. 130, pp. 7, figs. 2*).—A comparison of alfalfa hay alone and supplemented by other coarse fodders (prairie hay, corn silage, Kafir corn stover, and sorghum stover) was made with 2 lots of 10 steers each, the coarse feed being fed in addition to like grain rations.

On alfalfa hay alone the average daily gain per steer in the 143 days of the test was 2.83 lbs. and on alfalfa hay and other coarse fodder, 2.32 lbs, the cost of feed per pound of gain in the 2 cases being 5.28 cts. and 6.69 cts., respectively. The steers fed the alfalfa hay required 4.55 lbs. of coarse fodder and 5.78 lbs. of grain per pound of gain, and those fed alfalfa hay and other coarse fodder, 7.43 lbs. and 7.15 lbs., respectively.

The calculated profit in the case of the lot fed alfalfa hay was $5.85, and with the other lot $2.12. "The profit in either case was very small; indeed, so small as to hardly warrant steer feeding except as a means of marketing the feed of the farm. Alfalfa hay and corn-and-cob meal form a most excellent ration for fattening, and unless future experiments change these results, we shall have to admit that this combination gives better results than the use of a greater variety of roughage."

Methods of steer feeding. Barn v. shed—third trial, T. I. MAIRS and N. G. MILLER (*Pennsylvania Sta. Bul. 74, pp. 8*).—Continuing earlier work (E. S. R., 16, p. 398) the relative merits of feeding in sheds and barns was tested with 2 lots of 12 steers each.

The test began November 4 and closed March 7, the first 4 weeks being regarded as preliminary. In the test proper the average gain made with steers in barns was 127.1 lbs. and by those in sheds 127.6 lbs. Considering both the test proper and the preliminary period the values were 174.5 lbs. and 174.2 lbs. During the test proper the steers in barns consumed 18.67 lbs. of feed per pound of gain at a cost of 12.58 cts. Similar values for the steers fed in sheds were 18.42 lbs. and 12.40 cts. The conclusions drawn from the test were in effect as follows:

The general result of this experiment is at variance with those of the 2 preceding ones in the fact that the steers outdoors ate less food per pound of gain than the ones inside. It confirms the results of earlier work in that the actual amount of food eaten by the outside lot was less than that eaten by the inside lot, and that the gains made by fattening steers are not increased by warm quarters. It is not possible to have stables too cold for fattening steers in this climate, provided they are kept dry and well bedded. It is possible to keep open yards from becoming excessively muddy by the use of soft-coal cinders. A shed in a well-drained yard can be kept

practically as dry as the interior of a barn, provided plenty of bedding is used and the manure is removed sufficiently often.

Summarizing the 3 years' work, the average daily gain of the steers fed in barns was 1.94 lbs. and those fed in sheds 1.82 lbs.

Feeding trials, M. J. R. DUNSTAN (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 13–16*).—In the test of the relative merits of Aberdeen Angus, Galloway, Blue Grey, and Red Poll steers the greatest gain, 2.09 lbs. per day, was made by Blue Greys for 164 days and the smallest gain, 1.7 lbs. per day, by Red Polls for 88 days. As regards profits the Galloways ranked first.

Calf rearing, M. J. R. DUNSTAN (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 16–18*).—Brief notes are given on different substitutes for milk fat in calf feeding. In 112 days calves fed whole milk gained 1.5 lbs. per head per day as compared with 1.07 lbs. with those fed separator skim milk and cod-liver oil. About 4 oz. was found to be the maximum amount of oil which could be fed. A feed relished by calves was made up of oatmeal, ground linseed meal, linseed cake, and lentils 8:5:3:4, cooked overnight with a small quantity of salt and molasses and fed warm in the proportion of 3 lbs. of meal to 5 qts. of water.

Crossbred sheep, T. R. ROBINSON (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 21, 22, figs. 5*).—Hampshire, Kent, Suffolk, and Southdown sheep were used in the crossbreeding tests reported. Judging from the weights recorded the Hampshire-Kent, the Southdown-Suffolk, and the Suffolk-Kent crosses gave the best returns. The Hampshire-Kent lambs sold for the highest price. More twins were dropped by the Suffolk-Kents than by any of the other crosses.

Shearing lambs, M. J. R. DUNSTAN (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, p. 18*).—In a test of the merits of the practice of shearing lambs, it was found that a lot of 5 shorn lambs gained 58.2 lbs. in 36 weeks as compared with 72.8 lbs. in the case of a similar lot which had not been shorn at the beginning of the trial. The fleece of these lambs weighed 12 lbs. as compared with 7 lbs. in the case of the lambs shorn at the beginning of the trial. Definite conclusions were not drawn.

Maltese goats, J. H. GROUT (*Mo. Consular and Trade Rpts.* [*U. S.*], *1905, No. 298, pp. 105, 106*).—It is stated that there are about 12,000 goats in Malta, both long-haired and short-haired varieties being kept. The milk is considered of very superior quality and is used for table and cooking purposes, but not for the manufacture of butter and cheese. For these products sheep's milk is used. The law requires that goats slaughtered for market shall be at least a month old and shall weigh not less than 12 lbs. The average price of a fair Maltese goat is $15, though some of exceptional merit bring more. Other points connected with the Maltese goat industry are discussed.

The successful type of horse that may be profitably raised by New England farmers, H. W. SMITH (*Agr. of Mass., 1903, pp. 111–144*).—From a consideration of historical and other data, as well as existing conditions, the conclusion was reached that heavy harness horses are the best type for New England farmers to breed. The paper was followed by a discussion.

The influence of radium bromid on metabolism in dogs, W. N. BERG and W. H. WALKER (*Proc. Soc. Expt. Biol. and Med., 2 (1905), p. 89; abs. in Jour. Amer. Chem. Soc., 27 (1905), No. 12, Rev., p. 667*).—When radium bromid was fed to dogs in nitrogen equilibrium it was found that protein metabolism was not materially affected. The total sulphate in the urine was markedly increased.

An improved cage for metabolism experiments, W. J. GIES (*Amer. Jour. Physiol., 14 (1905), No. 5, pp. 402–412, figs. 4*).—A cage is described for use in metabolism experiments with dogs especially.

The farmer's poultry house, F. W. HODSON and F. C. ELFORD (*Canada Dept. Agr., Poultry Div. Bul. 8, pp. 15, figs. 22*).—Poultry houses which have given good satisfaction, constructed by the Canada Department of Agriculture, the Canadian

Poultry and Produce Co., the Truro (N. S.) Agricultural College, and by private individuals, are described and plans given. In these houses several points were specially sought—warm roosting pens, plenty of sunlight, fresh air without drafts, and convenience in cleaning. According to the authors the houses may be built with or without foundations.

"A cement or stone wall sufficiently underground to exclude rats and vermin is an advantage. The cost varies according to the price of lumber and help. The floor in most cases is the soil, though cement or wooden floors will give good satisfaction. . . . In calculating the number of fowls these buildings will accommodate, allow 6 to 8 sq. ft. of floor surface for each breeding fowl and give them from 5 to 10 times as much yard space. For each pen one male will be found sufficient, but it is sometimes advisable to change the male if not specially mated."

On the relative efficiency of poultry houses with and without ground ventilation, T. R. Robinson and E. J. Russell (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 175–186, fig. 1, dgms. 2*).—The experiments reported show that poultry houses without floors are not as satisfactory as those with floors, at any rate during the winter, notwithstanding the fact that from studies previously reported (E. S. R., 16, p. 588) the unfloored houses were found to be twice as efficient from the point of ventilation.

It was found that birds raised in floorless houses laid fewer eggs than the others, the difference in the value of eggs produced amounting to 25 cts. per bird for a period of 15 weeks. The temperature of the two houses and the carbon-dioxid content of the air was the same, so in the authors' opinion the reason for the differences observed was neither the purity nor the temperature of the air.

"The quantity of heat lost by the birds in the raised floorless house is, however, greater than in the other; more of their food is consequently required for fuel purposes, leaving less for other requirements. It appears to us that this is the reason of the superiority of the house with a floor.

"Poultry houses cost so little relative to the return they give that it is hardly worth while trying to overcome the difficulty. The simplest plan is to increase the accommodation for the birds, giving each one 10 cu. ft. of air space. Floors, either of wood or brick can then be put in.

"The above conclusions apply in their entirety to movable houses on wheels. If raised above the ground, they become floorless houses, placed on the ground they behave like houses with floors.

"It is absolutely essential to secure top ventilation. The houses received by us from the makers have usually been deficient in this respect, and we have had to bore holes in the eaves. By doing this we reduced the amount of carbonic acid in the air from 30 to 9 parts in 10,000 volumes, and effected an improvement in the eggs."

A practical poultry plant for southern California, E. P. Mitchell (*Los Angeles, Cal.: Out West Pub. Co., 1904, pp. 105, pls. 6, figs. 34, chart 1*).—In the author's opinion, the poultry industry in southern California is capable of great development and on the basis of experience he discusses such topics as buildings, hatching, brooders, houses, feed, water supply, and expenses for equipping a poultry plant with special reference to local conditions.

The poultry, T. R. Robinson (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, p. 25*).—Brief notes are given regarding the station poultry flock and cross-breeding experiments which have been undertaken. From White Minorcas crossed with Black Court-pattes a strain has been developed which it is proposed to call the White Crowns. These are distinguished by white plumage, short white shanks, and a long breast bone. They lay large white eggs, feather early as chickens, and make very fair table poultry.

The adaptability of concentrated by-products for poultry feeding, W. P. Wheeler (*New York State Sta. Bul. 271, pp. 387–403*).—The tests reported were made

with chickens and ducklings to study the comparative value of a number of concentrated feeds for supplying protein and mineral matter, constituents which the ordinary ration does not supply in sufficient quantity at times.

In the test with ducklings 3 lots containing 30 birds each at the beginning were fed during the period of most rapid growth rations in which 60 per cent or more of the protein was derived from by-products of animal origin. Except for a small amount of blood meal included in the grain mixture fed each lot the nitrogenous feeds were for lot 1, animal meal and meat meal; for lot 2, blood meal and bone meal; and for lot 3, milk albumin (a by-product from milk sugar factories) and bone meal. The average gain in weight per fowl for the 9 weeks of the test was 82.2 oz. on animal meal and meat meal, 67.7 oz. on blood meal and bone meal, 81 oz. on milk albumin and bone meal, the cost of a pound of gain in the 3 cases being 4.8, 5.7, and 6.1 cts.

In the test with chickens, which was made with 4 lots containing from 43 to 50 chicks 2 weeks old at the beginning of the trial, 2 of the lots were fed rations in which most of the protein was derived from highly nitrogenous animal by-products, namely, animal meal and milk albumin. Of the remaining 2 lots one received added protein in the form of gluten meal and the other gluten meal with a little bone meal. As a basal ration all lots were fed cracked corn, wheat, green alfalfa, and a grain mixture. In the 8 weeks of the test the average gains per bird were 12.9 oz. on animal meal, 11.5 oz. on milk albumin, 4.6 oz. on gluten meal, and 9 oz. on gluten meal and bone meal, the cost of a pound of gain ranging from 6.4 cts. on the last mentioned ration to 14.6 cts. on gluten meal.

The author's conclusions were in effect as follows: Of three highly nitrogenous rations fed to ducklings, the one containing dried blood and bone meal was associated with much slower growth than the one containing animal meal and that containing milk albumin and bone meal, though the same amount of food under each ration gave equal increase in weight. The superiority of the two rations mentioned seemed due chiefly to their greater palatability.

Of four rations carrying much concentrated food the one containing a large proportion of gluten meals proved inferior, when fed to young chicks, to that having bone meal in addition to gluten meal, and much inferior to others in which most of the gluten meal was replaced by animal meal or by milk albumin. Unpalatability seemed largely responsible for the inferiority of the two rations. The ration giving the poorest results was also deficient in mineral matter.

The rations containing milk albumin were more palatable and seemed more healthful than the others, but owing to the higher price of this food it was not profitably used in the desired quantity. The rations containing animal meal were more profitably fed.

The results and observations in general, like those from other trials, show a greater disadvantage in the free use of foods of uncertain palatability and healthfulness during earlier stages of growth than at any other time. The composition of the feeding stuffs used is reported.

Feeding cotton-seed meal to chickens (*Rel. Poultry Jour., 12 (1905), No. 8, p. 836*).—Cotton-seed meal if fed to poultry should, it is said, be fed separately. A ration of equal parts by weight of corn meal and wheat bran, with sufficient low-grade flour and middlings to roll into a ball and at the same time not be sticky, can be used with the cotton-seed meal, the latter constituting about 10 per cent of the whole mash.

Growth of chickens and cost of rearing, E. BROWN (*Jour. Bd. Agr. [London], 12 (1905), No. 5, pp. 257-272; reprinted by Univ. Col. Reading, Agr. Dept., 1905, pp. 16*).—To secure data regarding the growth of chickens and the cost of rearing, a test was made with White Wyandottes, Faverolles, Buff Orpingtons, and crossbreds.

The different lots each contained 29 or 30 birds and all received uniform treatment. When 13 weeks old the average weight of the chickens ranged from 1 lb. 14 oz. each

with the crossbred birds to 2 lbs. 3 oz. with the Buff Orpingtons, and the average cost per bird, including the original cost of egg and incubator and brooder expenses, ranged from 15.42 cts. with the crossbred birds to 17.32 cts. with the White Wyandottes. The cost of food per pound of gain was practically the same for all the lots, averaging 6.6 cts. It was noted that there was great variation in growth in different weeks of the test, though generally speaking the fluctuations were similar with all the breeds.

The eggs of domestic ducks and hybrid ducks. A contribution to the study of hybridizing, G. LOISEL (*Compt. Rend. Soc. Biol.* [*Paris*], *59* (*1905*), *No. 36, pp. 587–589*).—According to the author's observations a domestic duck's egg weighs on an average 70 gm. and contains on an average 9 gm. shell, 24 gm. or 21 cc. yolk, and 37 gm. or 36 cc. white, this quantity of yolk being made up of 13 gm. water, 7 gm. fat, and 4 gm. protein, and the white of 31.3 gm. water and 5.68 gm. protein. The eggs laid by a domestic duck crossed with a wild duck weighed on an average 60.5 gm. and contained 7.26 gm. shell, 29.9 gm. white, and 22.76 gm. yolk made up of 10.15 gm. water and 12.61 gm. dry matter.

The author concludes that the eggs of the crossbred ducks though smaller are superior to domestic ducks' eggs from a food standpoint since they contain more dry matter, and that crossing with the wild form is advantageous for continuing the desirable characteristics of domestic ducks.

The guinea fowl, H. DE COURCY (*Jour. Bd. Agr.* [*London*]), *12* (*1905*), *No. 9, pp. 533–536*).—A summary of data on the feeding, care, and management of guinea fowls. As the author points out, guinea fowls are important factors in reducing the number of insects, and since they gather most of their feed the cost of raising them is less than with other poultry.

DAIRY FARMING—DAIRYING.

A comparison of wheat bran and cotton-seed meal for milk production, J. MICHELS and J. M. BURGESS (*South Carolina Sta. Bul. 117, pp. 18*).—The authors state that a review of the literature bearing on the feeding of cotton-seed meal shows that no ill effects follow its rational use as a food for milk production, and that bad results are probably due to one or more of the following causes: (1) Feeding the meal in conjunction with unsuitable roughage, (2) feeding it in a stale or musty condition, and (3) feeding it in excessive quantity.

The bulletin gives the results of a feeding experiment in which 21 cows were fed for 3 periods of about 4 weeks each for the purpose of comparing cotton-seed meal and wheat bran and of studying the influence of cotton-seed meal on the health of cows. During the first and third periods the grain ration consisted of 3 lbs. of bran and 3 lbs. of cotton-seed meal, and during the second period 4½ lbs. of cotton-seed meal.

The average daily butter-fat production was 14.51 lbs. during the first period, 14.96 lbs. during the second, and 14.14 lbs. during the third, showing an increase of 0.63 lb. for the cotton-seed meal period as compared with the average for the 2 periods when bran was fed. The cost of butter-fat production was 18.7 cts. per pound in period 1, 16.2 cts. in period 2, and 19.3 cts. in period 3, showing a saving of 2.8 cts. per pound in favor of the cotton-seed meal period. The butter-fat production of individual cows varied in cost from 12.9 to 19.5 cts. per pound. It was estimated that the bran-and-meal ration fed in periods 1 and 3 had the same manurial value as the meal ration fed in period 2.

The health of the cows was apparently uninjured by the heavy meal feeding. The butter made during the second period was appreciably firmer than that during the other periods, but in other respects it was the same.

In what way is the feeder responsible for unsanitary milk? W. H. JORDAN (*Hoard's Dairyman, 37 (1906), No. 2, pp. 31, 33, figs. 2*).—The author defines sanitary milk, mentions the different ways in which the milk producer may come into possession of unhealthy animals, and discusses the various causes rendering milk unsanitary after it is drawn. Particular attention is paid to the effect of the different feeding stuffs on milk.

The author believes that there are comparatively few commercial feeding stuffs, which, when properly fed, may not be used with perfect safety to the flavor and sanitary condition of the milk.

Milk-testing societies in Sweden (*Jour. Bd. Agr. [London], 12 (1906), No. 10, pp. 608, 609*).—It is reported that beneficial results have followed the introduction into Sweden of the system of cooperative milk testing known as control societies. From the figures given it appears that the average milk production per cow has increased from 3,134 lbs. to 3,539 lbs. during 4 years, while the food consumption has decreased. In 1904 there were over 200 control societies in existence in Sweden.

On obtaining pure milk for infants, children, and invalids, W. HEMPEL (*München. Med. Wchnschr., 53 (1906), No. 7, pp. 300–303, figs. 4*).—This is a general discussion of this subject with a description of a dairy in which extra precautions were taken to prevent the contamination of milk.

The bacteriological examination of such milk showed the presence of 1,600 bacteria per cubic centimeter as compared with 33,000 to 370,000 in sanitary or pasteurized milk from other sources. An illustrated description is also given of a faucet for drawing milk from receptacles so that the sample would be obtained equally from all layers from top to bottom.

The sale of milk for human consumption, M. CASALINI (*La vendita del latte per l'alimentazione umana. Turin, 1905; rev. in Rev. Gén. Lait, 5 (1906), No. 8, p. 190*).—This gives the results of a study of the sale of milk in several cantons and cities of Switzerland.

Methods of bacteriological examination of milk, F. H. SLACK (*Jour. Infect. Diseases, 1906, Sup. 2, pp. 214–222*).—This description of the technique and apparatus used in the laboratory of the Boston Board of Health is offered with a view of provoking discussion and eventually securing agreement on uniform and efficient methods.

The samples are obtained by means of large glass pipettes and placed in test tubes. Plates are made with 1 per cent agar having a reaction of +1.5 and are incubated in a saturated atmosphere for 24 hours at 37° C. The sediment obtained by centrifuging 2 cc. of milk is smeared over a space of 4 sq. cm. marked on a glass slide, dried with gentle heat, stained with methylene blue, and examined microscopically for bacteria and pus cells.

Milk containing not over 50 cells to the field of the 1/12 immersion lens is allowed to pass. While streptococci are found in small numbers in most market milk, a milk is condemned when the following tests are all positive: (1) Microscopic examination of the sediment showing streptococci, diplococci, or cocci; (2) the plate from the same sample showing colonies resembling streptococci colonies in excess of 100,000 to 1 cc., and (3) the broth culture from these colonies showing streptococci alone or in great excess of the other bacteria present.

The microscopic estimate of bacteria in milk, F. H. SLACK (*Abs. in Science, n. ser., 23 (1906), No. 580, p. 211*).—The centrifugal apparatus used and the method of examining the sediment for bacteria are described. The method is believed to have the following advantages: Rapidity of examination, accuracy, easily learned technique, and lack of costly apparatus. While not considered equal in accuracy to plate counts it is believed that the method can, in experienced hands, be used with safety for certifying milk.

The bacteriological examination of milk, A. C. HOUSTON (*London: P. S. King & Son, pp. 48; rev. in Brit. Med. Jour., 1906, No. 2356, pp. 452, 453*).—The author ascertained the amount of dirt in milk before and after centrifuging, and made bacteriological examinations of 20 samples of milk from each of five sources. The sources of contamination of milk are discussed and the desirability of establishing temperature and bacteriological standards for milk is considered.

In order to be free from objection, milk, according to the author, should fulfill the following conditions: One cc. should not show the presence of *Bacillus enteritidis sporogenes;* 0.001 cc., the presence of *B. coli;* nor 0.0001 cc., the presence of streptococci. The primary sediment after 24 hours should not exceed 100 parts per million, nor the secondary sediment after centrifuging 50 parts per million. The problem of improving milk supplies is discussed and several reforms considered practicable are enumerated.

Lactic-acid bacteria, W. M. ESTEN (*Abs. in Science, n. ser., 23 (1906), No. 580, p. 210*).—Studies have been made of the lactic-acid bacteria isolated from samples of milk received from nearly every section of the United States and Canada.

Two distinct groups of lactic-acid bacteria have been found, (1) gas-forming bacteria, (2) nongas-forming bacteria. The first group consists of *Bacillus coli communis* and *Bacterium lactis aerogenes*, which is considered identical with the *Bacillus acidi lactici* of Hueppe. The second group, in the opinion of the author, consists of only one species of bacterium with its varieties, namely, *Bacterium lactis acidi* of Leichman. The first group is aerobic and the second facultative anaerobic.

Milk not containing *B. lactis acidi* is considered a dangerous product if kept for any length of time, inasmuch as it then becomes a good medium for the growth of all kinds of putrefactive bacteria and disease germs, while milk containing this organism soon becomes nearly free from other forms.

Kinds of bacteria concerned in souring of milk, P. G. HEINEMANN (*Abs. in Science, n. ser., 23 (1906), No. 580, pp. 211, 212*).—The author believes that all so-called lactic-acid bacteria belong to two groups, the colon aerogenes group and the streptococcus group, and states that this arrangement is arrived at by a comparative study of culture characteristics of pathogenic, sewage, fecal, and milk streptococci.

The ordinary bacteria producing lactic fermentation are stated to be *Bacillus aerogenes lacticus* and *Streptococcus lacticus* either alone or in cooperation. *Bacillus coli* and peptonizing bacteria it is believed may also participate in the souring of milk. The gas-producing organism is present in large numbers in initial stages but is ultimately stopped by the development of the streptococcus. Lactic-acid bacteria are believed to be of intestinal origin, gaining access to milk with particles of cows' feces.

Since *Streptococcus lacticus* is invariably present in fresh milk collected with good precautions it is believed that the sanitary significance of streptococci in market milk needs further investigation.

A note on the indol-producing bacteria in milk, S. C. PRESCOTT (*Abs. in Science, n. ser., 23 (1906), No. 580, pp. 212, 213*).—In studying the relation between the occurrence of indol-producing bacteria and the total number present in milk, bacteriological examinations were made of 524 samples collected from 175 different farms. The results obtained with 278 samples are tabulated.

Of 13 samples containing above 1,000,000 bacteria per cubic centimeter, 9 samples or 70 per cent showed the presence of indol; of 2 samples containing between 500,000 and 1,000,000, 1 sample or 50 per cent showed the presence of indol; of 34 samples containing between 100,000 and 500,000, 14 samples or 41 per cent showed the presence of indol; of 229 samples containing between 25,000 and 100,000, 32 samples or 14 per cent showed the presence of indol; and of 133 samples containing 25,000 or less, 17 samples or 12 per cent showed the presence of indol.

Bacteriological studies of some milk samples of abnormal properties, R. BURRI and M. DÜGGELI (*Centbl. Bakt. [etc.], 2. Abt., 15 (1906), No. 22-23, pp.*

709–722).—This gives the detailed results of bacteriological studies of 4 samples of milk, one designated as smelling like Limburger cheese, one as having a dog odor, one having a bitter taste, and one with the marked taste and odor of Glarus cheese.

The quantitative determination of leucocytes in milk, A. R. WARD (*Abs. in Science, n. ser., 23 (1906), No. 580, p. 211*).—Comparative determinations of leucocytes in milk were made by the method of Doane and Buckley of the Maryland Station and that of Stewart of the Philadelphia Bureau of Health. The Doane-Buckley method was found to give more satisfactory results in duplicate determinations than the other method mentioned.

On the reductases of cows' milk, E. SELIGMANN (*Ztschr. Hyg. u. Infectionskrank., 52 (1906), No. 2, pp. 161–178*).—The author distinguishes superoxydase, the enzym in milk which decomposes hydrogen peroxid, from a reductase. Both are believed to be bacterial products.

Among the bacteria having catalytic action are cocci previously described by the author, and among those producing reductase is a small, thick, nonliquefying bacillus isolated from milk. No essential differences were observed between the reduction of a weak alcoholic solution of methylene blue and of Schardinger's reagent which contains formaldehyde in addition to the methylene blue.

Aside from the reducing substances in milk due to bacteria, there are also present in the milk, according to the author's investigations, decomposition products of the casein which have similar properties. It is thought possible that these may be formed in the milk ducts even by bacterial action. The oxydases in milk, on the other hand, are not considered products of bacterial growth.

Biological and biochemical studies on milk, C. J. KONING (*Abs. in Rev. Gén. Lait, 5 (1906), No. 8, pp. 186–189*).—This report, which is the fifth upon this subject, deals with the enzyms in milk. The abstract gives the numerous conclusions reached by the author, among which are the following:

Milk does not contain an oxydase. A positive reaction with the tincture of guaiac ought to be attributed to the presence of peroxid in the tincture. Peroxydases are always present in milk and their presence may be demonstrated by Storch's test. The reaction of the peroxydases has no relation to the presence of catalase in milk. Colostrum in certain instances gives a positive reaction with the Storch test and a negative reaction with guaiac. The bacteria commonly found in milk do not develop oxydase nor peroxydase when inoculated into sterile milk.

Diastases are always present in milk. Certain common milk bacteria are capable of producing traces of diastase when inoculated into sterile milk. In pathological processes in the mammary gland the amount of diastase in the milk is increased.

Schardinger's reaction is to be attributed to the enzym reductase, which is encountered commonly in milk, and which may be produced by bacteria. Pathological processes in the mammary gland increase also the amount of reductase in milk.

Catalase is present in milk and may be determined quantitatively. One hundred gm. of fresh normal milk is capable of decomposing 110 mg. of hydrogen peroxid in 2 hours. Catalase in milk may be produced by bacteria and may be increased by disease of the udder. The quantity of catalase in milk is also increased by the presence of leucocytes.

The author does not believe that chemical analysis and the determination of the refraction of the serum permit the recognition of the milk from diseased animals. In certain cases, however, such milk may be recognized by the cryoscopic method and by the determination of electrical resistance.

Proteolysis in cows' milk preserved by means of formaldehyde, W. G. TICE and H. C. SHERMAN (*Jour. Amer. Chem. Soc., 28 (1906), No. 2, pp. 189–194*).—Samples of milk preserved with formaldehyde in the proportion of about 1:1,000 were

kept under laboratory conditions and analyzed at different intervals. It was not considered certain that all bacterial action was suppressed in this way. The results obtained are shown in the following table:

Distribution of nitrogen in milk preserved with formaldehyde.

	Age of samples, in months.					
	11.	17.	26.	43.	28.	37.[a]
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Lactose	4.25	4.37	4.46	4.46	4.68	4.76
Estimated loss of lactose	0.31	....	0.39	0.38	0.18	0.15
Acidity calculated as lactic	0.24	0.21	0.81	0.54	0.84	1.43
Percentage of total nitrogen, as—						
Casein	80.60	73.70	73.70	11.40	3.70	17.90
Albumin and syntonin	5.00	4.40	6.30	6.80	5.50	4.20
Proteoses	6.10	14.20	11.10	24.90	29.90	10.60
Peptones by bromin	0.60	0.90	2.30	10.10	10.70	....
Peptones by tannin	1.90	1.70	3.00	9.10	....	1.40
Peptones by phosphotungstic acid	2.20	1.90	5.20	10.70	....	....
Amino acids, etc., by tannin	6.40	5.90	5.90	47.80	50.20	65.90
Amino acids, etc., by phosphotungstic acid	6.10	5.70	3.70	46.20	....	....

[a] In this sample all of the nitrogen in a small lump of curd was estimated as present in the form of casein in the figures here given.

These results are noted as agreeing in essential features with the proteolysis brought about by galactase in the investigations of Babcock and Russell.

Domestic butter, A. McGill (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 107, pp. 12*).—This reports the analyses of 180 samples of butter intended for home consumption and collected during July, 1905. Only 1 sample contained borax and only 2 showed more than 15 per cent of water.

Contribution to the knowledge of Holland butter, A. Olig and J. Tillmans (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11* (*1906*), *No. 2, pp. 81–93*).—Analyses of numerous samples of butter made by the authors and of market samples are reported and discussed in completion of the work upon which a preliminary report was previously made (E. S. R., 16, p. 917).

The relative value of the different determinations for detecting adulteration of butter with animal fats is discussed. As fatty acids in food may, in part, pass into the butter, it is believed that data secured by methods depending upon the nature or amount of the fatty acids should be accepted only with a certain amount of caution. The most useful means of detecting foreign animal fats in butter are believed by the authors to be examination with the micropolariscope and determinations of the Reichert-Meissl and saponification numbers.

Butter making on the farm, E. H. Webster (*U. S. Dept. Agr., Farmers' Bul. 241, pp. 31*).—The various steps involved in butter making from the time of milking to the marketing and storing of the finished product are clearly set forth in a popular manner.

Use of pure cultures in the manufacture of Grana cheese, C. Gorini (*Rev. Gén. Lait, 5* (*1906*), *No. 8, pp. 169–172*).—Since 1903, 150 cheeses have been manufactured under practical conditions in order to determine the value of the cultures isolated by the author from excellent samples of this kind of cheese. The cheese was made and examined by a committee composed of manufacturers and dealers in Grana cheese.

While the work has not been carried on sufficiently long to warrant positive conclusions, the results so far are favorable to the use of the author's cultures. A value of 962 francs was placed upon 35 cheeses made with the pure cultures, while 35 made without the use of such cultures were valued at 689 francs. The author's method, as briefly stated in this article, is based upon strict hygienic measures in the production and handling of the milk as well as in the use of cultures.

Investigations on sour-milk cheese, C. H. ECKLES (*Ann. Agr. Suisse, 6 (1905), No. 8, pp. 323–332*).—In continuation of the investigations previously noted (E. S. R., 17, p. 291), the author made chemical and bacteriological examinations of 4 kinds of cheese from German sources and 2 kinds of Swiss cheese. The various organisms isolated were grown in sterile milk.

According to the conclusions reached by the author *Oidium lactis* commences to develop at once on the surface of cheese made without rennet and neutralizes gradually the acid produced by the lactic ferments. At the same time there is a development of a yeast, especially in places where the acid has been partly neutralized. These two organisms render the casein soluble, but the oïdium is considered the more important factor in this process. *Bacterium lactis acidi* is absent in the ripe cheese. The strong odor and the coating are attributed to the work of bacteria, among which is a yellow micrococcus which it is the author's intention to study later.

The ripening of Hartz cheese, II, C. H. ECKLES and O. RAHN (*Centbl. Bakt. [etc.], 2. Abt., 15 (1906), No. 25, pp. 786–790*).—In the first communication (E. S. R., 17, p. 291) it was reported that a yeast plays an important rôle in the ripening of this sour-milk cheese. Further experiments with sterile curd have confirmed this view. Descriptions are given of the various organisms found.

In a note to this article Rahn ascribes the disagreement in the results obtained by Eckles (see above) and himself to the fact that Eckles worked with sour milk and he with cheese.

Care of dairy utensils, O. ERF and C. W. MELICK (*Kansas Sta. Bul. 131, pp. 9–20, figs. 8*).—This consists of a general discussion of the care of dairy utensils with reports of two series of experiments in cleaning cream separators, the results of which are presented by the authors in the following conclusions:

"A cream separator should be thoroughly washed every time after using. A brush should be used on every part and piece, using 5 per cent solution of borax or other good washing powder. Rinse in hot water, or steam if possible. They should then be left to dry while hot. Wiping with an ordinary clean cloth contaminates utensils with innumerable bacteria.

"The bacterial contamination in milk is increased from three to five times by running it through a separator bowl which has been used and only flushed and left standing several hours. If only flushed while using, for several days, the contamination increases several times more, and such milk would be likely to be detrimental if fed to calves.

"The use of washing powder in flush water reduces the number of bacteria in the following batch of milk that is run through, and cleanses the separator more than hot water alone, but not sufficiently to warrant that method of cleaning.

"The use of a cream separator that is thoroughly washed reduces the number of bacteria in milk one-fifth to one-fourth.

"Improper cleaning is detrimental to a separator on account of the rust that accumulates on dirty or damp places. This may shorten the life of the machine many months, depending on the degree of cleanliness employed.

"Running milk through a dirty separator is similar to running it through a dirty strainer, with all of the filth of the previous milking left in it from twelve to twenty-four hours. The millions of undesirable bacteria from the dirt, manure, and slime lodged in the separator bowl spoil all the milk, to a greater or lesser degree, that passes through the machine.

"When properly used, a cream separator is a clarifier and to a certain extent a purifier of milk, but when carelessly used it is a source of filth and contamination."

Missouri State Dairy Association (*Mo. Bd. Agr. Mo. Bul., 5 (1905), No. 6, pp. 63, pl. 1, figs. 6*).—This is a summary of the proceedings of the sixteenth annual meeting of the Missouri State Dairy Association held in November, 1905. The addresses

which are printed in full deal with the value of silage for cows, European dairying, improvement of dairy cattle, guarding against the introduction of tuberculosis into dairy herds, the need of a dual purpose cow, profit in dairying, and quality in dairy products.

VETERINARY MEDICINE.

Diseases of cattle, sheep, goats, and swine, G. MOUSSU and J. A. W. DOLLAR (*London: Gay & Bird, 1905, pp. XVIII+785, pls. 17, figs. 316*).—The present volume is based largely on Moussu's "Maladies du Bétail" and other literature of German, English, and American origin. The subject-matter is classified according to the organs affected. The volume constitutes a valuable edition to the literature of veterinary science in English and is well illustrated.

Annual report of the State board of live stock commissioners (*Ann. Rpt. Ohio Bd. Agr., 59 (1904), pp. 713-774, figs. 15*).—The work of the State board of live-stock commissioners during the year is briefly outlined.

A detailed discussion is presented of a number of common diseases observed in the State, together with a map showing the distribution of each disease in the State. The more important of these diseases are anthrax, actinomycosis, glanders, hog cholera, swine plague, nodular disease in sheep, rabies, sheep scab, tuberculosis, etc. A copy is given of various laws passed by the State legislature relating to live stock and the duties of the live-stock commissioners. Notes are also given on the prevention of swine plague and hog cholera by P. Fischer.

The method of procedure of the board of live-stock commissioners in dealing with tuberculosis is outlined. The tuberculin test is being applied to cattle whenever request is made by the owner, and it is believed that in all instances the owner receives the full market value which could be expected for animals when found diseased.

Infectious diseases of animals and the live stock industry of the State, P. FISCHER (*Ann. Rpt. Ohio Bd. Agr., 59 (1904), pp. 394-400*).—Attention is called to the prevalence of various animal diseases in Ohio, particularly to glanders, tuberculosis, actinomycosis, rabies, trichinosis, and intestinal parasites. Brief recommendations are made regarding methods of preventing the outbreak and distribution of these diseases. The economic importance of animal hygiene is discussed.

Annual report on the distribution of animal plagues in the German Empire (*Jahresber. Verbr. Tierseuch. Deut. Reiche, 19 (1904), pp. VI+287, pls. 4*).—The present report is occupied with a discussion of the more important animal plagues, with particular reference to their distribution in various parts of the German Empire. The diseases included in the statistical account are anthrax, blackleg, rabies, glanders, foot-and-mouth disease, pleuro-pneumonia of cattle, horse mange, sheep scab, hog cholera, swine plague, fowl cholera, fowl plague, tuberculosis, etc. In an appendix to the report the distribution of these diseases is set forth in detail in a tabular form.

The veterinary section, A. THEILER (*Transvaal Agr. Jour., 4 (1905), No. 13, pp. 69-96*).—Particular attention is given to a discussion of the stock diseases of South Africa, including horse sickness, which is apparently transmitted by insects, rinderpest, heart water of domestic ruminants transmitted by *Amblyomma hebræum*, red water transmitted by *Rhipicephalus decoloratus*, biliary fever of horses transmitted by *R. evertsi*, malignant jaundice of dogs transmitted by *Hæmaphysalis leachi*, east coast fever transmitted by *Rhipicephalus appendiculatus* and *R. simus*, tsetse fly disease transmitted by *Glossina morsitans*, etc. J. M. Christy presents a report on measles in the pig with notes on the symptoms by which it may be recognized, diagnosis of the disease, etiology, and its economic importance.

Immunization with exudates and bacterial extracts, J. CITRON (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1905), No. 1, pp. 153-155*).—The immunity produced by

the use of aggressins is believed not to be different from that brought about by bacterial extracts. The author has demonstrated to his own satisfaction that aggressins are contained in bacterial extracts, and that the antiaggressins are identical with the complements. An active as well as a passive immunization can, therefore, be brought about in this manner.

The transportation of tetanus toxin to the spinal centers through the nerve fibers, N. TIBERTI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 38* (*1905*), *Nos. 5, pp. 499–510; 6, pp. 625–644, pl. 1*).—In the author's experiments it was found that in guinea pigs and rabbits the ischiatic nerve may absorb the tetanus toxin and transport it to the nerve centers when the toxin is applied to the cut end of the nerve.

In the transference of the tetanus toxin the necessity of an intact axis cylinder is apparent. When tetanus toxin is introduced subcutaneously into a susceptible animal it is mostly absorbed by the lymphatics and passes thence into the blood. A small portion of the toxin, however, is found in the nerve trunks of the region. The tetanus toxin is transported to the nerve centers not through the lymphatics of the nerves but in the actual nerve fiber, particularly the axis cylinder. When the tetanus toxin is injected into the muscle it spreads about and comes in contact with the nerve fibers by which it is absorbed. Tetanus toxin introduced into the gastrocnemius muscles of guinea pigs is found in the ischiatic nerve within one and one-half hours.

Minute doses of tetanus toxin may, therefore, produce a symptom of the disease, provided it comes in direct contact with the nerves. If tetanus antitoxin is injected into a nerve trunk and toxin injected later into the corresponding muscles, the antitoxin will prevent the toxin from reaching the central nervous system.

A report on human and bovine tuberculosis, H. KOSSEL (*Brit. Med. Jour.*, *1905, No. 2344, pp. 1445–1449*).—The author presents a summarized account of his investigations in the German Imperial Health Office in cooperation with other investigators.

During the extensive studies carried on under these auspices the conclusion was reached that there are two distinct types of tubercle bacillus, the bovine and human. Tuberculosis in cattle is to be traced exclusively to infection with bovine tubercle bacillus. Swine are susceptible to both forms and human tuberculosis arises chiefly from an infection with the human bacillus. Tuberculous lesions in man may, however, be produced by the bovine tubercle bacillus and the disease may be transmitted to human beings by food derived from tuberculous animals, especially by cows' milk.

The origin of tuberculosis, methods of combating it, and feeding young animals, E. VON BEHRING (*Beitr. Expt. Ther., 1904, No. 8, pp. 1–138*).—This article contains an account of the principles upon which the author's method of immunizing cattle against tuberculosis is based, the details regarding methods of performing this operation, and considerable controversial matter.

While cattle appear to be more susceptible than any other animal to natural infection with tuberculosis, it has been found in the author's experiments almost impossible to inoculate them by means of the hypodermic method. During the past 6 years 20 cattle have received, hypodermically, enormous quantities of tubercle cultures, in some cases as high as ½ liter, without producing any infection. When these animals were killed and carefully examined several months or even years after inoculation no trace of tubercle bacilli was found and no evidence of infection. If this is found to be generally true it will readily explain the negative results from the hypodermic inoculation of cattle with tubercle bacilli of human origin. Cattle are readily infected by intravenous inoculation.

The author believes that calves and children may be immunized against tuberculosis by preventing the occurrence of live tubercle bacilli in the food, and by feeding them milk treated with formaldehyde so as to destroy the tubercle bacilli and leave uninjured the immunizing bodies found in tuberculous milk. For this purpose

formaldehyde may be added to milk at the rate 1 part to 40,000. It is maintained by the author that the protective bodies are regularly found in the blood when the animal is in the process of recovery from infection.

The only true remedy for infectious diseases appears, therefore, to consist in the use of protective bodies obtained from the blood or other body fluids of animals which have recovered from the disease in question. The chief danger of infection of both calves and children is believed to occur in early life from drinking milk containing tubercle bacilli. The appearance of pronounced symptoms of the disease may not be noted until later life.

Immunization of cattle against tuberculosis, E. VON BEHRING (*Beitr. Expt. Ther., 1905, No. 10, pp. 1-21*).—In this article a brief review is presented of the work thus far carried out at the Marburg University under the author's direction, especially on the problem of vaccinating cattle to render them immune against tuberculosis. An attempt is made to present definitions of certain terms used in connection with this problem, especially virus, vaccine, jennerization, pasteurization, immunity, etc.

It is reported that about 10,000 cattle have been immunized according to the author's method with good results. This work has been done partly by men working directly under the author and partly by other veterinarians. The small proportion of failures which have occurred seem to be capable of explanation, so that no serious defect has been found in the method.

The action of tubercle bacilli of different origin, R. LINK (*Arch. Hyg., 53 (1905), No. 3. pp. 264-274*).—In order to test as delicately as possible the differences in morphology and pathogenic action between tubercle bacilli of human and bovine origin the author inoculated rabbits in the anterior eye chamber with accurately weighed quantities (0.0001 to 0.0002 gm.) of cultures of tubercle bacilli. The bacilli of human origin came from an advanced case of consumption, that of bovine origin was obtained through the kindness of Professor von Behring.

A preliminary test of these cultures showed that guinea pigs inoculated in the body cavity with the human bacilli died within 23 days of generalized tuberculosis, while the bovine bacilli did not seem to be so virulent when inoculated in this manner. The results obtained in various experiments are presented in a tabular form. It appeared from these experiments that the bovine bacilli are short rods without any granulation, while the human tubercle bacilli frequently show granulation. Guinea pigs inoculated with human bacilli showed large numbers of the tubercles, while the bovine bacilli appeared more likely to produce diffuse inflammatory processes.

No differences were observed in the pathological processes whether the animals were inoculated with 0.0001 or 0.0002 gm. of the cultures. In general the course of the disease was more severe after infection with bovine than with human tubercle bacilli. A general infection, however, took place in all cases.

Tuberculosis in cattle and tuberculin tests of the station herd, J. M. SCOTT (*New Mexico Sta. Bul. 55, pp. 15, pls. 5*).—Notes are given on the nature, symptoms, method of infection, and prevalence of tuberculosis. The nature of tuberculin is briefly stated, together with directions for making the tuberculin test.

The literature relating to the subject of feeding tuberculous milk is discussed. Two calves from tuberculous cows were allowed to take the milk of these cows. Both of these calves developed tuberculosis, while a third calf, also from a tuberculous cow, did not develop the disease when not allowed to take its mother's milk. It is believed that tuberculosis could be eradicated from the Territory by a thorough application of the tuberculin test and the destruction of reacting cattle. A test of the station herd, consisting of 19 calves, indicated that 15 per cent were tuberculous.

Vaccination against tuberculosis in Melun, E. THIERRY (*Jour. Agr. Prat., n. ser., 10 (1905), No. 50, pp. 749, 750*).—A brief account is given of experiments carried out in Melun by Vallée. The cattle on which the experiments were made

have all been slaughtered, and the results show that in vaccination may be had the most satisfactory method of controlling tuberculosis.

The experimental disease caused by inoculation with tubercle bacilli from which the oil has been removed, J. CANTACUZENE (*Ann. Inst. Pasteur, 19 (1905), No. 11, pp. 699–714*).—It has long been known that tubercle bacilli killed by heating to a temperature of 120° C. remain toxic and when inoculated into guinea pigs may cause serious disease or death.

The author wished to determine the effect of the complete removal of fat from tubercle bacilli. For this purpose bacilli in glycerin bouillon were kept at a temperature of 60° C. for 1 hour on 5 successive days. The dead bacteria were then filtered, dehydrated in vacuum, and treated in a Soxhlet apparatus by a successive exposure to methyl alcohol and petroleum ether. After from 36 to 48 hours all trace of fat had disappeared. The bacteria thus treated were of bovine origin and of a virulence sufficient to kill guinea pigs within 36 hours after inoculation with a dose of 20 cm.

Within 2 hours after inoculation of a fatal dose of bacteria treated as just described the temperature of guinea pigs fell several degrees. This subnormal temperature persisted for 6 hours. During the progress of the disease the blood becomes eosinophilous, the kidney hyperemic, the muscle fibers of the heart swollen, and other pathological lesions appear. When smaller doses were given the subnormal temperature was rapidly followed by fever, emaciation of the animal, and the formation of tuberculous nodules or abscesses which were later resorbed entirely.

Further experiments showed that tubercle bacilli, killed and deprived of their fat, cause an acute necrosis of the leucocytes when given in fatal doses, while in small doses they produce similar symptoms of less duration and an enormous hypertrophy of the spleen. Animals inoculated with such bacilli react in a typical manner to tuberculin for a period of several weeks. When such bacilli are treated with Gram's mixture of iodin and potassic iodid they cause no necrosis. The active resorption of treated bacilli may be caused by daily injections of iodid of potash after inoculation.

Ranilla, J. C. SEGURA (*Bol. Sec. Fomento [Mexico], 5 (1905), No. 1, I, pp. 140–166, figs. 12*).—Ranilla has been shown to be a disease of cattle identical with Texas fever of this country and tristeza of South America. It is transmitted from diseased to healthy cattle by means of the cattle tick. The pathogenic cause of the disease is the same blood parasite which is observed in Texas fever, and treatment for the disease should, therefore, be the same as adopted against Texas fever.

Abortion in cows, T. W. CAVE (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 245–248*).—A brief account is given of contagious and noncontagious abortion in cows, with a discussion of remedies for the contagious form. The plan adopted by the author consisted in the isolation of all aborting cows, destruction of the fetuses and fetal membranes, and a thorough application of Izal at the rate of 1 to every 80 to 200 parts of water.

The treatment of infectious vaginal catarrh, ATTINGER (*Berlin. Tierärztl. Wchnschr., 1905, No. 50, pp. 845–848*).—The literature relating to this disease in cattle is critically reviewed.

As a result of the author's study of this disease it is concluded that it is not possible to adopt rational governmental orders for the control of the disease, for the reason that the nature of the disease is not sufficiently well known. It is not absolutely certain that the disease is infectious or caused by micro-organisms. The results of experiments thus far made are at variance regarding the methods of treatment, and opinions differ widely also regarding the economic importance of the disease.

Parasitic gastro-enteritis, F. G. ASHLEY (*Vet. Rec., 18 (1905), No. 912, p. 448*).—For a number of years the author has observed cases of gradual emaciation in young steers grazing on swampy pastures. At first some of the cases were thought to be tuberculosis, but later recovered. Occasionally acute symptoms developed and

the animals died within about 60 hours. Post-mortem examinations made on such cases showed the presence of *Strongylus gracilis*, and the disease is therefore to be considered as of parasitic origin.

Mortality in cattle caused by eating poison tulip, J. D. STEWART (*Agr. Gaz. N. S. Wales, 16 (1905), No. 10, pp. 956–959, figs. 3*).—In a herd of 96 cattle 25 died from eating *Homeria miniata*. In some cases death occurred within a few hours, while other cases lingered for 2 or 3 days and some recovered. The mucous membrane of the fourth stomach and of the intestines was greatly inflamed. Feeding experiments showed that 3 oz. of the plant was sufficient to cause serious symptoms of poisoning in heifers.

On the occurrence of hydrocyanic acid in Johnson grass, M. E. JAFFA (*Cal. Bd. Health Mo. Bul., 1 (1905), No. 2, pp. 11, 12*).—The death of cattle in Los Banos, California, was reported as due to eating Johnson grass. A preliminary analysis of this grass showed conclusively that it contained hydrocyanic acid. A quantity of fresh Johnson grass was then obtained, and upon analysis was found to contain 0.05 per cent hydrocyanic acid, while barnyard grass from the same locality contained no poison.

The poisonous action of Johnson grass, A. C. CRAWFORD (*U. S. Dept. Agr., Bur. Plant Indus. Bul. 90, pt. 4, pp. 6*).—The literature relating to the chemistry of Johnson grass and related species is briefly reviewed in connection with bibliographical notes. Some reports have been received since 1902 regarding the supposed poisonous action of this grass. In a sample obtained from Santa Rosa, California, positive tests for hydrocyanic acid were obtained. The grass is reported as poisonous when grown on either irrigated or nonirrigated lands, but especially so when the grass matures rapidly.

Diseases of sheep, T. W. CAVE (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 239–244, fig. 1*).—The author discusses pernicious anemia in sheep due to the presence of *Strongylus contortus* in the fourth stomach. Many cases of this disease came under his attention. The worm is described and notes are given on its life history. The best means of preventing infestation is to keep close watch upon the condition of the water supply of sheep.

Anthrax in the horse, J. R. MCCALL (*Vet. Rec., 18 (1905), No. 911, pp. 429, 430*).—A brief account is given of this disease in horses with special reference to a case in which the symptoms develop very rapidly, resulting in death. The source of infection was probably turnips which came from a neighborhood where anthrax had occurred. It was also possible that infection was spread to some extent by traffic in wool which was carried on in connection with the same stable. Judging from the clinical symptoms in this case, the bacilli gained entrance through the lymphatics of the throat.

Variations in the content of agglutinins and precipitins in the blood during an infection with glanders, A. BONOME (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), Nos. 5, pp. 601–611; 6, pp. 732–740*).—The experiments reported in this paper were carried out on horses, asses, cats, and guinea pigs.

The blood serum of horses during experimental infection with glanders and also during artificial immunization against the glanders bacillus shows a pronounced increase in the agglutinin content. This increase takes place more rapidly after inoculation through the nasal mucous membrane than when infection takes place through the alimentary tract. During the period of mallein reaction the agglutinating power of the blood of glanderous horses is increased. The same may be said for the blood of horses which no longer react to mallein.

It was found that the agglutinating power of the serum of glanderous horses was entirely destroyed by heating for 1 hour at a temperature of 62 to 65° C. The agglutinating power reappears, however, upon the addition of normal serum of other animals in the proportion of 1:2.

The diagnostic value of agglutination in glanders, J. SCHNÜRER (*Centbl. Bakt. [etc.] 1. Abt., Orig., 39 (1905), No. 2, pp. 180–187*).—The author describes in some detail the technique of the method including the taking and sending of blood samples, repetition of this process, the preparation of the tests, and the judgment of results. It appears that between the 2 groups of decidedly positive and negative results some uncertain cases will appear which require a repetition of the test.

The unity of dourine, G. E. SCHNEIDER and M. BUFFARD (*Ann. Inst. Pasteur, 19 (1905), No. 11, pp. 715–717*).—Attention is called to the difficulty of demonstrating the blood parasite in cases of dourine. The author was able, however, to determine the presence of *Trypanosoma rougeti* as the cause of dourine in France.

Studies on Trypanosoma duttoni, THIROUX (*Ann. Inst. Pasteur, 19 (1905), No. 9, pp. 564–572, pl. 1*).—This blood parasite was found in the blood of house mice, and notes are given on its appearance and on successful methods of cultivating it. The various forms which it assumes in artificial cultures are also noted. The organism may be reinoculated from one specimen to another of house mice and also to other species of the same genus. Rats and guinea pigs, however, seem to be refractory. The blood of animals recovered from infection contains no agglutinin toward *Trypanosoma duttoni*.

Trypanosomes in the blood of inoculated animals, A. NISSLE (*Arch. Hyg., 53 (1905), No. 3, pp. 181–204*).—The observations reported in this article were made on laboratory animals inoculated with *Trypanosoma brucei, T. equinum*, and *T. lewisii*. Rats, white mice, and guinea pigs were the chief experimental animals employed. The author describes in some detail the morphological changes undergone by the blood parasites in these experimental animals, their movements, microscopic structures, reaction of the blood cells toward them, and other related matters. A brief bibliography of the subject is appended to the article.

Experimental trypanosome diseases, L. HALBERSTAEDTER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 38 (1905), No. 5, pp. 525–532, pl. 1*).—The author reports in considerable detail the degrees of infection of white mice and rabbits with the trypanosomes of dourine, mal de caderas, and nagana. The technique of staining trypanosomes is also briefly considered.

On trypanosomes and their presence in the blood of Brisbane rats, C. J. POUND (*Proc. Roy. Soc. Queensland, 19 (1905), No. 1, pp. 33–38*).—In recent years the author has frequently observed trypanosomes in the blood of rats. Notes are given on the technique of examination of fresh and stained specimens of rat blood containing the trypanosome of surra.

A new endoglobular hematozoan, J. J. VASSAL (*Ann. Inst. Pasteur, 19 (1905), No. 4, pp. 224–231*).—An endoglobular protozoan is found in *Sciurus griseimanus*. Inoculation experiments showed that this organism is not pathogenic for man, monkeys, rabbits, guinea pigs, or pigeons. Brief notes are given on its appearance.

The spread of plague infection by insects, W. HUNTER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1905), No. 1, pp. 43–55*).—From a review of the literature of the subject and from the author's experiments it is concluded that insects may carry *Bacillus pestis* and may, therefore, be the means of disseminating this organism over wide areas.

Sucking insects, such as fleas, bugs, etc., mechanically convey infection from place to place in the same manner as other insects. Apparently the danger from the bites of the insects has been exaggerated. It appears that the spread of infectious diseases by insects is accomplished indirectly by the deposition of plague bacillus on foods, clothing, and household material.

The tapeworms of Australia, N. A. COBB (*Agr. Gaz. N. S. Wales, 16 (1905), Nos. 2, pp. 153–168; 3, pp. 209–219; 4, pp. 301–318; 7, pp. 619–631, figs. 34*).—The anatomy of tapeworms is discussed, and notes are given on the methods of collecting them for study and on the life history of these pests. In the special discussion of the

subject attention is given to tapeworms of the cat, dog, and horse, with especial reference to those forms which are of economic importance as parasites of man or important domestic animals.

The method of distribution of trichina embryos, C. Stäubli (*Vrtljschr. Naturf. Gesell. Zürich, 50 (1905), No. 1-2, pp. 163-176*).—By means of feeding experiments with mice, guinea pigs, and other experimental animals the author studied the method of distribution of trichina embryos after hatching in the intestines.

During these experiments infested muscle tissue from human beings, pigs, and rats was used. When samples of the cardiac blood were taken for study, a number of trichina embryos was found in every case in the blood, the number varying from 2 to 230 in the different samples. In order to demonstrate the trichina embryos most easily it was found desirable to stain with acid eosin and methylene blue. Trichina embryos were found in the blood within 7 days after the infested meat was eaten.

The author's investigations on laboratory animals lead him to believe that the young embryos are not carried through the vena portæ, but through the thoracic duct. This view of the subject of the distribution of trichina embryos makes it possible to understand more readily how they make their way so rapidly from the intestines to various muscles of the body.

An infectious pneumonia of rabbits and its treatment with antiserum, H. J. Südmersen (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 38 (1905), Nos. 5, pp. 591-600; 6, pp. 713-732, figs. 2*).—The investigations reported in this paper have been under way for 3 or 4 years and were undertaken to discover the cause of an epidemic among laboratory rabbits.

Post-mortem examinations indicated that *Bacillus A* was present in the lungs of 68 per cent of all rabbits affected with the disease. The same bacillus was obtained in pure cultures from the lungs of guinea pigs affected with pneumonia. Pneumonia in rabbits is usually accompanied by a nasal discharge. It is probable that certain forms of pneumonia may arise secondarily to other infections, but the majority of infections are due to *Bacillus A*. In cultivating this organism a toxin is produced.

It was found possible in the injection of attenuated cultures to protect rabbits against subsequent infection. The immune serum produced in such rabbits showed pronounced agglutinative and bactericidal properties. The use of the serum is very effective in producing immunity, but the immunity is passive and not of long duration.

Serum treatment for dog distemper, A. H. Meis (*Berlin. Tierärztl. Wchnschr., 1905, No. 50, pp. 848, 849*).—A test was made of Piorkowski's serum in the treatment of dog distemper. No effect was produced by the use of this serum and the author believes that it is useless to attempt the manufacture of protective sera so long as the micro-organism of the disease is not definitely known.

The study of mixtures of antirabies serum and fixed virus, P. Remlinger (*Compt. Rend. Soc. Biol.* [*Paris*], *59 (1905), No. 37, pp. 658-660*).—The author found that intracerebral injections of fixed virus and antirabies serum in rabbits were quite without effect. The action of this mixture is pronounced, however, when inoculated under the skin or in the peritoneum. The effect of the mixture is to produce a pronounced resistance to rabies.

The protection of dogs against rabies by mixtures of fixed virus and antirabies serum, A. Marie (*Compt. Rend. Soc. Biol.* [*Paris*], *59 (1905), No. 37, pp. 637-639*).—The author found that when dogs were inoculated with a mixture containing 3.5 cc. of antirabies serum and 2.5 cc. of fixed virus they were thereby rendered immune to fatal doses of rabies virus. In other experiments the amount of the mixture used varied from 10 to 60 cc., but in general it is recommended that the mixture consist of $\frac{1}{3}$ virus and $\frac{2}{3}$ antirabies serum. By using this mixture it appears

to be possible to protect dogs against rabies by a single injection for a period of at least one year.

The so-called premonitory fever as a symptom of experimental rabies, J. VON LÖTE (*Centbl. Bakt. [etc.], 1. Abt., Orig., 39 (1905), No. 1, pp. 32–35*).—From careful determinations of the temperature of normal rabbits the author believes that the body temperature is sufficiently regular to prevent any confusion between normal temperatures and the fever which is regarded as premonitory of an outbreak of rabies. This fever was considered as a perfectly natural occurrence indicating the beginning of the disease.

The action of radium rays upon the virus of rabies in vitro and in the animal organism, G. TIZZONI and A. BONGIOVANNI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 39 (1905), No. 2, pp. 187–189*).—In the authors' experiments it was found that the virus of rabies in vitro or in the animal organism is rapidly destroyed under the influence of radium rays.

Sleepy disease of chickens, C. DAMMANN and O. MANEGOLD (*Deut. Tierärztl. Wchnschr., 13 (1905), No. 50, pp. 577–579, fig. 1*).—On an estate in Westphalia a disease broke out among chickens and affected nearly all of a flock of one hundred. The affected fowls showed a roughness of plumage, swollen eyes, paleness of the comb, and lameness. The appetite appeared to be fairly good during the course of the disease.

When a post-mortem examination was made, striking symptoms of hemorrhagic septicæmia were found. The musculature was permeated with bloody effusions and red spots were observed in the mucous membrane of the intestines. The spleen was considerably enlarged, and hemorrhagic patches were observed in other parts of the body. A capsule-bearing streptococcus was found in large quantities in the blood. This organism is described under the name *Streptococcus capsulatus gallinarum*. It is either aerobic or anaerobic, and differs in many respects according to the animal in which it is inoculated or the artificial medium in which it is cultivated. It is quite susceptible to heat and is destroyed in 2 minutes by exposure to a 1 per cent solution of carbolic acid.

The disease may be readily transmitted by inoculation of virulent blood to other chickens. When thus inoculated the most striking symptom in the fowls is sleepiness, and this symptom determined the name of the disease. The disease may be transmitted by subcutaneous inoculation to pigeons, rabbits, and white and gray mice.

The protective properties of blood from animals affected with fowl cholera and immune to aggressin, E. WEIL (*Arch. Hyg., 54 (1905), No. 2, pp. 149–184*).—A thoroughly protected immune serum appears not to exist in a case of fowl cholera. The positive results obtained by active immunization, however, make it probable that blood of animals treated with an exudate containing aggressin contains protective substances.

The author's experiments were carried out on rabbits and the immune serum used in the experiments came from rabbits which have been immunized by means of a very virulent culture of fowl cholera bacillus. Serum thus obtained was tested on mice, and it was found that 0.1 cc. of the serum was sufficient to protect mice against a bacterial dose which killed control animals in less than 24 hours. When tested on rabbits it was found that from ½ to 1 cc. of the protective serum was a safe and effective dose for one of these animals. Experiments with pigeons and chickens were not so satisfactory. When the protective serum and the active virus were inoculated at the same time it was found that the serum was sufficient to prevent the development of the disease in mice, rabbits, and guinea pigs.

RURAL ENGINEERING.

Hydrologic work of the U. S. Geological Survey in the Eastern United States, M. L. Fuller (*Rpt. Internat. Geogr. Cong., 8 (1904), pp. 509–514*).—An outline of the work of the division of hydrology which deals with underground waters.

An American and a European bibliography is being prepared, statistics regarding wells, and technical papers on pumping and drilling are published from time to time, and both the scientific and economic sides of underground water supply are investigated. A compilation of the law of underground waters is under way.

The author discusses also the relation of hydrology to geography and the mapping of hydrologic features.

Hydrographic work of the U. S. Geological Survey, G. B. Hollister (*Rpt. Internat. Geogr. Cong., 8 (1904), pp. 515–522*).—A general review of the work undertaken by the hydrographic division, which includes measurements of the quantity of water, both on the surface and underground, and records of stream flow extending over long periods, as well as studies of the quality of waters for domestic and industrial uses. The publications of this division include annual reports and the well-known series of Water-Supply and Irrigation Papers.

Prehistoric irrigation in the Navaho Desert, E. L. Hewett (*Records of the Past, 4 (1905), No. 11, pp. 323–329, pls. 4*).—Remains of large irrigating systems have been found in Gila and Salado valleys, which show great engineering skill, in sharp contrast with the extremely crude earth and stone dams commonly found around pueblo ruins.

The writer, in a trip across Navaho Desert, found well-preserved ruins near Una Vida of a reservoir puddled with clay and riprapped, fed by a diverting ditch; a stone dam at Kinklizhin with a waste way cut in the solid rock; and at Kinbineola a reservoir in a natural depression with a ditch 2 miles long run on a fairly uniform grade, showing stone retaining walls in places.

These remains show "the existence of a system of prehistoric irrigation in the midst of the Navaho Desert that is intermediate in its plane of development between the advanced system of the Gila drainage and the very rudimentary form common to the entire pueblo region. It represents but modest achievement as compared with that of the Gila people, but marked advance over the common achievements of the prehistoric pueblos."

Irrigation in Mildura, C. J. Grant (*Victorian Inst. Engins., 1905, pp. 2–18, figs. 2*).—The duty of water pumped into a canal and distributed to 9,000 acres in fruit and vines is found to be somewhat higher than in America and India, the depth applied being 2.2 feet measured at the head of the canal.

The loose sandy "pine" soils require less water when well cultivated than the heavy "blue brush" soil. On account of great heat and dryness, three irrigations in a season of 125 days, applied in deep furrows, are made in preference to a number of very light applications. The failure of rating flumes to give close results with very light grades has led to the design of a new device for measuring water to individual laterals, by means of an inverted siphon arranged so that a current meter is turned by the water as it rises, a series of dials indicating discharge in cubic units. In the main canal submerged weirs have been used for measurements to avoid unnecessary increase in pumping head.

Season and crop report of the Bombay Presidency for the year 1904–1905, H. S. Lawrence (*Dept. Land Rec. and Agr. Bombay, Ann. Rpt. 1905, pp. 12+LXI*).—This report contains statistics as to rainfall, areas of crops, yields, and prices for the Bombay Presidency proper, and the Sind.

The season was one of short rainfall, and therefore of decreased acreage. As a consequence prices were in general higher than usual. Cotton prices, however, were an

exception to this, although the crop was short, the low prices being attributed to the large American crop. As a result of the low rainfall the area irrigated from the canals and tanks was considerably reduced, but there was a large increase in the area irrigated from wells. In the Bombay Presidency proper more than half of the total irrigated area (789,476 acres) was irrigated from wells. In the Sind about one-sixth of the total area (3,000,000) was irrigated from wells.

The use of water in France, A. BACKHAUS (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 32, pp. 247–254, figs. 13*).—Irrigation in the departments of southeastern France is reviewed, and the working of State aid for canals is described, with the object of dissipating popular errors as to the extent and possibilities of irrigation in France.

In this connection it is pointed out that "it is an error to suppose that southern France is short of rain and that irrigation is a prerequisite for farming, but while crops may be raised without irrigation, the application of water insures intensive crops such as market gardens, green fodder, and crops raised by hand labor." It is admitted that while the French can not show as fine meadows as are found in Germany, they excel in canal construction and in irrigation organization. "The unity of the entire water and land system is an important thing in France, and similar provisions are needed in Germany, especially those for placing water rights on a common basis for all Germany and the management of all water affairs under one office. The French system provides for companies or syndicates administering their own affairs under government inspection, usually with government subvention."

As an example of the working of government aid on a large canal, a case is described where a grant of $700,000, the total cost being $1,100,000, was made to a syndicate, besides a guaranty of 4.5 per cent on the rest of the investment, in the expectation that the earnings would more than defray interest and maintenance. But owing to "a lack of intelligent interest on the part of the farmers, in the face of the example of other departments where irrigation has been successfully practiced for centuries," the government has had to pay an annual deficit to cover the guaranty.

The necessity of using government funds only in cases where self-help is stimulated thereby is urged, cases being cited where a single grant or bonus was made with no guaranty with good results. The duty of water, rates paid, and winter irrigation are discussed. The leaching of valuable constituents from the soil is considered an important matter, in France and Germany, and the liberal use of fertilizers is recommended. An estimate of the actual profits of irrigating meadows and other crops is given.

Irrigation. A few hints on the preparation of the land and the practical application of water, F. G. CHOMLEY (*Agr. Gaz. N. S. Wales, 16 (1905), No. 10, pp. 1003–1010, figs. 11*).—A résumé of practice in New South Wales and California, describing furrow and check methods of irrigating, cement ditches, and wooden sluice boxes.

The size of irrigated farms (*Forestry and Irrig., 11 (1905), No. 11, pp. 516–518*).—An argument in favor of making the homestead unit under national reclamation projects 80 acres rather than 40 acres, based on the probability that alfalfa will be the main crop for a number of years and that more than 40 acres in hay is needed for the reasonable support of a family.

The diminished yield of underground waters in southern California (*Engin. Rec., 52 (1905), No. 15, pp. 405–407*).—Underground waters are an important source of supply for irrigation in this region, there being 3,000 artesian wells and 1,600 pumping plants, developing 400 to 500 cu. ft. per sec., irrigating about 150,000 acres.

The artesian conditions are peculiar in the valley of southern California, the artesian basins being formed by a sheet of clay parallel to the surface, at no great depth, overlying deep beds of detritus. These basins lie in a series along the course of Santa Ana River, and constitute reservoirs for its storage. Owing to the low cost of driving wells into these basins the drafts on the supply have for years exceeded

inflow, causing a large and continuous shrinkage in the artesian area, even in ordinary wet years. The writer believes these drafts will be restored by extraordinary wet seasons, but that the irrigated area should not be increased hereafter.

The value of meadows and their irrigation, STRECKER (*Fühling's Landw. Ztg., 54 (1905), No. 20, pp. 678–693*).—After showing the high importance of meadows to animal industry the possibility of a large increase in hay crop by the correction of streams, drainage, and especially by irrigation, is urged.

It is estimated that the crop on one-third of the total area of 15,000,000 acres may be increased nearly 50 per cent, thus increasing the total yield by about 16 per cent. Suggestions are given for laying out irrigated meadows. The importance of irrigation and drainage to remove humic acid by aeration and other salts by solution, and the distribution of fertilizers by irrigation are discussed.

The writer concludes that (a) small streams may be cheaply used; (b) water is most easily controlled on low riparian meadows; (c) the simplest system should be used to distribute water; (d) the regulation of stream flow by numerous small dams is a benefit to power users except during low water; (e) small storage reservoirs are useful; (f) irrigated hay if properly handled brings a better price than common hay; (g) the drainage from small towns should be utilized; (h) ground water may be raised to advantage by wind power; (i) steep land will absorb more rainfall if furrowed transversely; (j) a small quantity of water will insure a good aftermath.

Water as a plant food, BACKHAUS (*Fühling's Landw. Ztg., 54 (1905), No. 22, pp. 757–762*).—The quantity of water used by plants in Germany in producing one part of dry matter is estimated as 350 parts, or about 14 inches of rain for a crop of 4.5 tons to the acre.

In hay culture, light, heat, and plant food are usually abundant, the crop depending solely on available water. Experiments during 1904 showed increases in yield due to irrigation as follows: Oats—grain 35 per cent, straw 56 per cent; wheat—grain 94 per cent, straw 169 per cent; grass—1st cut 220 per cent, 3rd cut 348 per cent; hemp 46 per cent.

The actual value of increase in crop for each cubic meter of water applied was 1.3 cts. to 3.3 cts., equivalent to $27 to $70 per acre foot.

The author reviews the methods to be employed, noting the relation of irrigation to water power and the value of local organization. Deep culture, increase of humus, the selection of suitable plants, the chemical action of water, the value of sewage irrigation, and the importance of land drainage are discussed.

Cultivation of salt lands, A. ROLET (*Jour. Agr. Prat., n. ser., 9 (1905), No. 22, pp. 710–712*).—A method of removing sodium chlorid by flooding in square checks and draining in open ditches is described, and for the complete reclamation of salt lands for the use of vineyards, it is recommended that rice be grown one or two years, grain two or three years, and then rice again to complete the removal of salt.

Laying out rice plantations, G. CARLE (*Jour. Agr. Prat., n. ser., 10 (1905), No. 46, pp. 626–630, figs. 3*).—Directions for surveying and constructing dikes, laterals, drains, and leveling checks for rice fields, with special reference to quantitative estimates of cost. The methods suggested are adapted to rough lands and to crops other than rice.

A report on terrestrial magnetism and meridian line work in Louisiana, W. C. STUBBS, G. D. HARRIS, ET AL. (*Geol. Survey La. Bul. 2, pp. 49, pls. 6*).—This bulletin summarizes the results of work which has been done with a view to establishing meridian lines in Louisiana for the use of surveyors, engineers, and land holders, and of measurements which have been made to ascertain the changes that are continually taking place in the earth's magnetic field within the State.

The model farm, F. GRAFTIAU and E. WARNANTS (*La ferme démonstrative. Liège: Henri Poncelet, 1905, pp. 42, pls. 2, figs. 3*).—A description of a model farm plant, built

for the Belgian section of the Exposition Universelle at Liège in 1905, giving a complete bill of materials used and an account of the society which built the plant.

Wind for electric power, F. VON LEPEL (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 45, pp. 373-375, figs. 2*).—The author believes that while wind power has been limited hitherto to pumping and grinding, neither of which operations requires constant speed, by connecting a dynamo and accumulating the current in a storage battery, all ordinary needs for farm power, including heat and light, may be met.

A crude device which allows the drive belt to loosen and slip on its pulley is proposed to regulate speed and prevent injury to the dynamo, but the method of stepping up the speed from 12 revolutions per minute at the mill to 900 at the dynamo is not described. An editorial note appended says:

"The article . . . is based partly on material furnished by windmill makers, and does not give data for an estimate of the actual power of windmills. The statement of actual work done by Swedish plants seems too high . . . for according to the assertions of German makers, considerably larger mills would be required for the same service. Many attempts have been made in Germany to use wind for electric power, but it is known to us that all the large electric concerns strongly believe it to be impracticable . . . on account of the unsteady power and speed."

Replying to this comment (21 (1906), No. 1, pp. 3, 4) Dr. von Lepel refers to a book on the subject by Prof. La Cour for quantitative data, and deplores the lack of interest on the part of large manufacturers in small plants for farms.

A letter is also published from a Dresden firm urging the necessity of auxiliary steam or gas power in addition to storage batteries, and describing a successful wind-electric plant for 120 lamps run by a modern 24-ft. mill, using a horsepower machine with four horses for auxiliary power.

The electrical value of wind power (*Sci. Amer., 93 (1905), No. 21, pp. 394, 395*).—A description of the plant of C. F. Brush in Cleveland, Ohio, which has been in use for sixteen years to run 100 16-candlepower lights, and a plant in Wittkeil in Schleswig that develops 30 horsepower in an 8-mile wind, for lighting a town. Other methods which substitute compressed air or elevated reservoirs for the expensive storage battery are suggested, but it is admitted that the problem is as yet unsolved.

British progress in pumps and pumping engines, P. R. BJÖRLING (*London: Archibald Constable & Co., 1905, pp. XII+92, figs. 97*).—This brief practical treatise on British pumps is the second volume of a series called National Engineering and Trade Lectures, edited by B. H. Morgan, and is a review of the various kinds of pumps, with notes on their selection for general and special purposes, intended to stimulate colonial and foreign trade in British machinery.

The farm automobile, G. VOIGTMANN (*Landw. Masch. u. Geräte, 6 (1906), No. 1, pp. 1-5, figs. 8*).—An improved gasoline traction engine is described, with a discussion of its advantages over fuel-burning engines. The illustrations show field trials of the machine.

Construction and ventilation of farm buildings (*Bul. Maine Dept. Agr., 4 (1905), No. 3, pp. 77-99*).—This bulletin contains five short articles and eight pages of correspondence relating to barns and silos.

Implements and machinery at the Smithfield Show (*Impl. and Mach. Rev., 31 (1906), No. 369, pp. 1033-1072, figs. 31*).—This report contains notes on 120 exhibits. The machines that seem to attract the most interest are swath turners, farm traction motors, milking machines, and combined planters and manure spreaders. An ingenious turnip thinner is described, and a number of root and feed cutters. Many new farm engines and motors are noticed.

Farm machinery in Belgium during the past twenty-five years, J. PYRO (*Ann. Gembloux, 16 (1906), No. 1, pp. 1-12*).—A cursory and somewhat technical

review of recent progress in the design, manufacture, and use of various farm machines, with special reference to the implement industry in Belgium.

Ancient Egyptian farm implements, A. DE CÉRIS (*Jour. Agr. Prat., n. ser., 10 (1905), No. 40, pp. 433-436, figs. 12*).—A description of the four-man plow and other implements found in inscriptions, with notes on their manner of use.

Recent improvements in hay making (*Canad. Impl. and Vehicle Trade, 12 (1906), No. 3, pp. 28, 29*).—The great importance of the quick curing of hay has encouraged the improvement of hay tedders, the most recent of which is the side-delivery rake.

"These machines are put into the hay immediately after it is mowed, the primary object being to uncover and heat a section of the meadow surface as the best means available in returning the hay to that section of forcing the curing by bottom heat, as well as by the incidental stirring. The rows can be re-turned at any time afterward on to the hot surface alongside, the repeated soft action of the machine doing no injury."

The corrosion of fence wire, A. S. CUSHMAN (*U. S. Dept. Agr., Farmers' Bul. 239, pp. 31*).—This bulletin is published as an answer to numerous complaints from farmers of the rapid rusting of galvanized fence wire.

The manufacture of iron and mild steel and the methods used in drawing and galvanizing wire are described, with special reference to the use of manganese, which is shown to be the possible cause of deterioration, owing to its influence on electrolytic action. It is admitted, however, that further tests are necessary to establish this theory. Besides decreasing the percentage of manganese it is proposed to ground the wires at intervals, so as to reduce electrolysis. A heavier coating of zinc, such as is used on telephone wires, is thought to be worth trying, but probably too expensive.

Teaching agricultural engineering in land-grant colleges, C. J. ZINTHEO (*Engin. News, 54 (1905), No. 25, pp. 658-662*).—The enormous increase in the use of farm machinery and in its cost as compared to other items of agricultural expense has contributed to make the study of farm machinery an important branch of instruction in agricultural colleges.

Although the schools of European countries are in the lead in agricultural engineering, the agricultural colleges in Wisconsin, North Dakota, Minnesota, and Iowa now offer more or less complete courses of a very practical sort, and several other colleges are organizing the same sort of instruction. The writer includes under agricultural engineering drainage, irrigation, roads, farm motors, and farm buildings as well as machinery.

RURAL ECONOMICS.

Farming as a business enterprise, E. C. PARKER (*Amer. Mo. Rev. of Reviews, 33 (1906), No. 192, pp. 62-67*).—This article emphasizes the growing importance of business methods on the farm, and outlines the investigations which are being carried on by the Minnesota Station, in cooperation with this Department, to determine the cost of producing field crops and live-stock products under farm conditions in Minnesota.

"Methods of keeping 'farm accounts' in a simple, practical manner are being worked out from the experience gathered," and it is hoped that a system of accounting may be devised which will enable the farmer to choose rationally from the various crops and the various kinds of live stock which may be produced upon his farm, and also to be able to compare the relative profitableness of the different methods of carrying out the operations of the farm.

The poor and the land, H. R. HAGGARD (*London: Longmans, Green & Co., 1905, pp. XLI + 157, pls. 6*).—This is a report on the agricultural colonies established by the Salvation Army in the United States and at Hadleigh, England. Fort Romie, in California, and Fort Amity, in Colorado, are described and discussed at considerable length. The purpose of these colonies is the removal of poor people from the cities

and their establishment in the country where they may live by carrying on agriculture.

The following quotation gives a brief statement of the conclusions reached by the author: "At both Fort Romie and Fort Amity I found the settlers healthy, happy, hopeful, and, almost without exception, doing well. Beginning in nearly every case with nothing, moreover, in the course of about four years at Fort Romie these settlers are now worth an average of about $2,000 per head above all their debts and liabilities to the Salvation Army and others, and at Fort Amity an average of about $1,000. . . .

"The venture, however, has not proved so prosperous to its founders, the Salvation Army, who on these two settlements have incurred a total loss of about $50,000. This loss is due to four causes: (1) The fact that the settlements were established by aid of money borrowed at a heavy rate of interest, namely 5 and 6 per cent, and that the settlers were charged too little for their holdings which they pay for by installments. (2) The considerable initial cost of the estate both at Fort Romie and Fort Amity. (3) The fact that the settlers were first established at Fort Romie before the soil had been properly irrigated and at once confronted by a three years' drought. (4) The circumstance that at Fort Amity the land, which was virgin prairie, proved exceptionally hard to work; also to be impregnated with alkali or natural salts, whereof the presence was totally unsuspected at the time of buying, of which alkali it has cost much money to be rid by deep draining. So it comes about that although the settlers are doing so well, the Salvation Army have been called upon to pay $50,000 for their experience."

Grazing on the public lands (*U. S. Dept. Agr. Forest Serv. Bul. 62, pl. 1, map 1*).—This bulletin contains a discussion of the condition of the grazing areas of the public domain, and the regulations which are essential to the orderly and economical use of these lands.

On some of the ranges the supply of grass and other stock feed is now more abundant than in former years, but on the greater number the grazing value of the lands has greatly diminished in recent years. Overstocking is the principal cause of the deterioration. Where pastures have been fenced or where the control of the range has been secured through the ownership of the watering places by the ranchmen, the condition of the range has been improved. But where many ranchmen are struggling to secure the same forage, a short-sighted policy is inevitable, the ranges are overstocked and their carrying capacity greatly reduced, to the detriment of the grazing industry. As a result, a large majority of the ranchmen are dissatisfied with the present condition of affairs, and favor "Government control of the ranges under reasonable regulation."

"The sentiment among stockmen seems to be rapidly changing in this regard, and many who formally opposed any form of control or leasing are now in favor of such action, provided the change is brought about gradually and with care to avoid any unnecessary disturbance of present range divisions and methods of use. It is almost the unanimous opinion of stockmen that in the adoption of any new system of management for the public grazing land, ample provision should be made for the gradual settlement of the country by actual home seekers."

The leasing of tracts of grazing land to individuals seems to be the most favored plan of regulation. The report contains an extended discussion of the systems of leasing State lands in Texas and Wyoming, and of the lands of the Northern Pacific Railway in eastern Washington.

The world's grain production in 1905 (*Die Getreideproduktion der Welt im Jahre 1905. Budapest: Royal Hungarian Minister of Agriculture, 1905, pp. 92*).—Statistics on the production of wheat, rye, barley, oats, and maize in 1905 are given for the different countries of the world. The countries are grouped into those importing and those exporting grain.

AGRICULTURAL EDUCATION.

Agricultural education in Lancashire, J. Bayne (*Roy. Lancashire Agr. Soc. Jour., 1905, pp. 26–41, figs. 12*).—Following a brief statement concerning the origin of agricultural education in Lancashire, the writer outlines the policy of the educational work and describes its different phases.

These include agricultural instruction at the Agricultural College of the Harris Institute, Preston; instruction in dairying both at the permanent dairy school on the county council farm, Hutton, near Preston, and also by means of migratory teachers; instruction in poultry work at the poultry school on the county council farm and by means of migratory teachers; lectures on agriculture, dairying, poultry keeping, horticulture, veterinary science, and bee keeping at various centers in the county; advisory agricultural work in the county and experimental work at the farm and elsewhere in the county.

All of the agricultural work is under the control of an agricultural subcommittee, consisting of representatives elected by the education committee of the Lancashire County council, by the council of the Harris Institute, and by the council of the Royal Lancashire Agricultural Society. The agricultural course at Harris Institute is intended to prepare young men and women for the practical work of the farm, and extends over 4 years, each session beginning in September and ending about the first of May. Each student is not only given free instruction, but if not a holder of a junior or senior agricultural scholarship is allowed a sum not exceeding $2.40 per week by the county council. Tuition fees are required of nonresident students.

The instruction given at the dairy school, the poultry school, and by means of lectures in different parts of the county is confined to the single branch of agriculture under consideration, while the agricultural work in Harris Institute includes also instruction in chemistry, zoology, mathematics, electrical engineering, mechanical engineering, drawing, natural science, physics, surveying, and woodwork.

Agricultural college extension (*Mass. Bd. Agr. Nature Leaflets 1–32*).—Beginning March 28, 1900, the State Board of Agriculture of Massachusetts has published 32 nature leaflets, all of which have a more or less direct economic bearing, as the following titles indicate:

(1) Canker Worms, A. H. Kirkland (pp. 3, figs. 4); (2) Tent Caterpillars, A. H. Kirkland (pp. 3, figs. 4); (3) The Black Knot of the Plum and Cherry, G. E. Stone (pp. 4, figs. 2); (4) Spraying Mixtures for Insects and Plant Diseases, H. T. Fernald (pp. 3); (5) The White-marked Tussock Moth, H. T. Fernald (pp. 3, fig. 1); (6) The Spiny Elm Caterpillar, H. T. Fernald (pp. 4, figs. 3); (7) Potato and Apple Scab, G. E. Stone (pp. 4, figs. 2); (8) Insects Injuring Lawns, H. T. Fernald (pp. 3, fig. 1); (9) Poison Ivy, G. E. Stone (pp. 4, figs. 3); (10) The Datanas, H. T. Fernald (pp. 2, fig. 1); (11) Quince Rust, G. E. Stone (pp. 3, figs. 2); (12) Winter Birds at the Farm, E. H. Forbush (pp. 7, figs. 3); (13) Peach Leaf Curl, G. E. Stone (pp. 4, figs. 2); (14) Owl Friends, E. H. Forbush (pp. 6, figs. 3); (15) Bird Houses, E. H. Forbush (pp. 6, figs. 4); (16) Our Friend the Chickadee, E. H. Forbush (pp. 8, figs. 4); (17) Bordeaux Mixture, G. E. Stone, (pp. 5, figs. 2); (18) Plant Lice or Aphids, H. T. Fernald (pp. 3, fig. 1); (19) Edible Weeds and Pot Herbs, G. E. Stone (pp. 5, fig. 1); (20) Massachusetts Weeds, G. E. Stone (pp. 7, figs. 2); (21) Potato Rots, G. E. Stone (pp. 4, figs. 4); (22–25) Hints for Outdoor Bird Study, E. H. Forbush (pp. 22, figs. 4); (26) The Brown-tail Moth, A. H. Kirkland (pp. 4, figs. 4); (27) The Gypsy Moth, A. H. Kirkland (pp. 4, figs. 5); (28) The Garden Toad, A. H. Kirkland (pp. 5, fig. 1); and (29–32) School Gardens, with directions for planting and care of school gardens, suggested crops, and the educational results of school-garden work, H. D. Hemenway (pp. 29, figs. 11).

Popular agricultural education in Jamaica, J. R. Williams (*Jour. Jamaica Agr. Soc., 9 (1905), No. 11, pp. 403–409*).—The causes of early failure and of more

recent success in efforts to provide agricultural instruction in the schools of Jamaica are here discussed by the Jamaica inspector of schools.

The writer points out as some of the essentials of success the importance of preparing the way by creating interest and sympathy in the work among the adult population and of giving much attention to the preparation of teachers for the new requirements imposed upon them. Nearly half of the teachers now at work in the elementary schools have received training in teaching agriculture.

The most important future needs are said to be the establishment of a college of agriculture in the island and the development of agriculture in the elementary schools as a feature of the educational work, not as a separate subject to be specialized, that is to say, agriculture should be taught primarily because of its educational value.

Syllabus of illustrated lecture on profitable cattle feeding, F. B. MUMFORD (*U. S. Dept. Agr., Office Expt. Stas., Farmers' Inst. Lecture 4, pp. 21*).—The topics specially considered in this lecture, designed for farmers' institute workers, are conformation to type, quality, breeding, age, and feeding methods, as these are the factors of most importance in determining profit in cattle-feeding operations. A list of 45 lantern slides designed to illustrate the lecture is included.

Syllabus of illustrated lecture on silage and silo construction for the South, A. M. SOULE (*U. S. Dept. Agr., Office Expt. Stas., Farmers' Inst. Lecture 5, pp. 31*).—In addition to the syllabus there are added more detailed directions for building various types of wooden silos, with estimates of materials and cost. A list of references is also given.

Syllabus of illustrated lecture on essentials of successful field experimentation, C. E. THORNE (*U. S. Dept. Agr., Office Expt. Stas., Farmers' Inst. Lecture 6, pp. 24*).—This syllabus, which was prepared for the purpose of aiding farmers' institute lecturers, gives suggestions on the way of carrying out successful field experiments. In this connection the selection of the soil, arrangement of plats, preparation of land for crops, planting and cultivation, harvesting, weighing, keeping the records, and the continuity of the work are discussed. A list of 32 lantern slides illustrating methods for conducting agricultural experiment work is given, together with a list of references to publications bearing on the subject.

MISCELLANEOUS.

Eighteenth Annual Report of Georgia Station, 1905 (*Georgia Sta. Rpt. 1905, pp. 111–119*).—This contains the organization list, a brief report by the president of the board of directors, a report of the director on the work of the station during the year, and a financial statement for the fiscal year ended June 30, 1905.

Hawaiian Sugar Planters' Station Report, 1905 (*Hawaiian Sugar Planters' Sta. Rpt. 1905, pp. 59*).—This consists of a general report on the work of the station during the year by the committee of the Hawaiian Sugar Planters' Association having this matter in charge, and appendixes containing detailed reports of the divisions of agriculture and chemistry, entomology, and pathology and physiology.

The same matter is also issued in the form of a yearbook consisting of the report proper, and in addition reprints of Bulletins 12–15 of the division of agriculture and chemistry, parts 1–6 of Bulletin 1 of the division of entomology, Bulletins 1–3 of the division of pathology and physiology, and a revised reprint of the report of the station for 1904, all of which have been previously noted or are noted elsewhere in this issue.

NOTES.

Idaho University and Station.—The main building of the university was destroyed by fire March 30. The building was the first one erected upon the grounds, and was a large and imposing structure containing the administrative offices, assembly hall, museum, and a large number of class rooms and laboratories. The experiment station office, library, and laboratories were located in the basement and were also destroyed. The building was insured for $106,500, which will cover about half the loss upon it.

Maryland Station.—Raymond Outwater, of the George Washington University, has been appointed assistant chemist of the station. Investigations on sweet corn are planned to be carried on at the station in cooperation with the Bureau of Chemistry and the Bureau of Plant Industry of this Department. M. N. Straughn will be in immediate charge of this work. The legislature has increased the appropriation for maintenance by $5,000, making it $10,000 a year. The appropriation for the State horticultural department has been increased to $12,000, with the provision that $4,000 shall be used by the station for investigation.

Massachusetts Station.—A contract has been entered into with the Bureau of Soils for the establishment of a substation in Concord, Mass., for experiments with asparagus. The cranberry insects are to be studied in the cranberry districts of this State the coming season by an expert employed for the purpose. Cooperative experiments with fertilizers for cranberries will also be undertaken.

Frederick R. Church, assistant agriculturist, has resigned to assume the management of a large farm. He is succeeded by Erwin S. Fulton, who has been an assistant in chemistry at Wesleyan University and in the nutrition investigations at Middletown.

Ohio Station.—The State legislature has established a department of forestry at the station, to carry on studies in forestry as related to the industry of the State. No additional appropriation is made for carrying on this new line of work.

Oklahoma College and Station.—C. E. Quinn, assistant in agronomy, has resigned to enter the employ of the Bureau of Plant Industry of this Department. L. A. Moorhouse, now on leave attending the University of Illinois, has been appointed professor of agronomy in the college and agronomist in the station, beginning July 1. W. L. Burlison, a graduate of the college in 1905, who has since been attending the University of Illinois, has been appointed temporary assistant in agronomy in the college and station. H. G. Beard, Shawnee, Okla., has resigned from the board of regents. His successor has not been appointed.

The new shop and gymnasium building has been completed. Work on Morrill Hall is progressing at a rate which insures its completion by the opening of the fall term.

Rhode Island College and Station.—Howard Edwards, M. A., LL. D., professor of English literature and modern languages at the Michigan Agricultural College, with which institution he has been connected for the past fifteen years, has been elected president of the college, to succeed Kenyon L. Butterfield at the close of the college year. The station is planning for extensive cooperative experiments with farmers of the State this season.

Vermont College and Station.—Morrill Hall, the new agricultural building for which appropriation was made last year, and for which a site has recently been secured, will probably be 60 by 90 ft. and at least three stories in height above the basement. It is expected to construct the building of brick, with stone basement and trimmings. The work will be pushed as rapidly as possible, in the hope that it may be made ready for the opening of the fall term.

The new Weather Bureau station, erected by the U. S. Department of Agriculture on the university grounds, has been completed. The building stands nearly opposite the experiment station farm, is of colonial style, and presents a very pleasing appearance. The observer of the station will live in the building and will have one assistant.

Semicentennial of Maryland Agricultural College.—The fiftieth anniversary of the establishment of the college was celebrated with appropriate exercises March 6. The date which these exercises commemorated was that of the passage of the act by the legislature establishing and endowing the college, which two years later was located on its present site.

President R. W. Silvester reviewed the history of the State charter, outlined the position of the college, and gave special attention to the important function of the agricultural colleges in training men for the great basic industry. Governor Warfield presented documentary evidence to show that the movement for the Maryland College started in a memorial to the legislature in 1837.

President Ira Remsen, of Johns Hopkins University, defined science, its aims and applications. He showed the application of pure science and made an eloquent plea for the value of investigation and discovery which was undertaken for the purpose of advancing knowledge, but not with a commercial idea or a direct view to its practical applications. He urged that it is only through such work that the fund of knowledge can be added to and the basis enlarged for application in the arts.

Prof. L. H. Bailey declared that the agricultural college stands for the freest democracy in education. He showed the youthfulness of agricultural science in comparison with pure science, and the great value of science in agriculture. In comparing American and German experimental work, he stated that the former is practical but not fundamental, while the German is fundamental without being practical. The American has, as he said, revolutionized everything in farming since Washington's time, except the man, and attention is now being given to reaching the man. He prophesied that while at present the farm often does not inspire and satisfy the educated boy, because it is so unprogressive, in future only the educated and thinking man can succeed on the farm, as the requirements of farming are becoming so much greater and success more difficult to attain. He extolled the great opportunities for young men in this country to assume leadership in rural and agricultural affairs.

Secretary Wilson urged the importance of teaching agriculture in the rural schools and of training teachers for this instruction. He asserted that "the power of the farm to create and produce has not half been reached," any more than has the power of the man to produce. The agricultural cóllege teaches the boy how to do things, how to do them better, and how to produce more. The work of the agricultural college of the future was sketched and great development and usefulness was predicted for it.

Prof. F. A. Soper spoke for the alumni of the college. The occasion was one of interest and enthusiasm for agricultural education and for the Maryland College.

Agricultural Chemical Experiment Station at Vienna.—According to a reorganization of this station, noted in a recent number of the *Wiener Landwirtschaftliche Zeitung*, the station now includes the following divisions: (1) Plant production and vegetation station at Korneuberg, O. Reitmair, chief, and Ferdinand Pilz, assistant; (2) dairying and feeding, Max Ripper, chief; (3) wine and other alcoholic drinks, fruit juices, and vinegar, Bruno Haas, chief, and Victor Kreps, Walter Fischer, and

Julius Schuch, assistants; (4) moor culture, uses of peat, moor culture station at Admont, and heating materials, William Bersch, chief, and Dr. Zailer, assistant; (5) chemical-technical investigations for private persons, J. F. Wolfbauer, chief, and Edward Hoppe and Adolf Halla, assistants; (6) chemical-technical investigations for officials, Franz Freyer, chief, and Theo. Schmitt, assistant.

Tea Experiment Station in India.—In accordance with plans previously noted (E. S. R., 16, p. 217), the Indian Tea Association has established an experiment station at Heeleaka, near Moriani, Assam, known as the Heeleaka Experimental Station and located on a tea plantation set out in 1862 and 1865. The object of this station is to study some of the partly solved problems concerning the character of soil suited to tea production, the best methods of production, and the best system for the renovation of deteriorated tea, as well as many other less practical but no less fundamental problems concerning the relation of the various operations of tea culture to the composition of the tea leaf, and hence to the quality of the tea. The experiments undertaken thus far have dealt solely with problems of tea culture, but it is proposed to take up also the equally important problems of manufacture.

Poultry Fattening Station in Ireland.—The Department of Agriculture and Technical Instruction for Ireland has established a station at Avondale, Rathdrum, for training young men in the breeding and fattening of poultry, with a view of preparing them to undertake the management of fattening stations in other parts of the country. Apprenticeships may extend over a period of from 6 to 12 months.

Experimental Farm at Nangeenan, West Australia.—The Western Australia department of agriculture has started an experimental farm at Nangeenan, 95 miles east of Northam, for the purpose of testing the possibilities of agriculture in the dry region east of the Avon Valley. The farm was located in June, 1904, but no crops were grown until last year. The results of the first season's tests were encouraging, indicating that with proper care in preparing the ground and putting in the crops good yields can be had.

International Conference on Plant Breeding.—The Third International Conference on Plant Breeding will be held at Westminster, England, July 30–August 3, 1906. Prof. W. Bateson will be president of the conference.

Conference for Education in the South.—The Ninth Annual Conference for Education in the South will be held at Lexington, Ky., May 2–4. One session of the conference will be devoted to agricultural education, at which addresses will be delivered by Dr. James W. Robertson, of the new Macdonald College at St. Ann de Bellevue, near Montreal, and Dr. Seaman A. Knapp, of this Department. Among those who are expected to give addresses at other sessions are Prof. N. S. Shaler, of Harvard; Dr. Brown Ayres, of the University of Tennessee, and Hon. John W. Yerkes, of Washington, D. C.

Agricultural Schools in Porto Rico.—The Report of the Commissioner of Education of Porto Rico for the fiscal year ended June 30, 1905, shows that during that year 11 agricultural schools were maintained. This is 3 less than were maintained in 1904, the decrease resulting from inability to secure teachers properly qualified to give instruction in agriculture. The average daily attendance at these schools was 41, and the average number of days actually taught was 170.

The reports of superintendents of different districts indicate varying degrees of success in carrying on these schools, depending largely upon the ability of the teacher and his attitude toward the subject. The superintendent of District No. 2, with headquarters at Carolina, reports very enthusiastically concerning the agricultural school in his district. He says that the pupils have produced a good crop of cane, and have demonstrated that vegetables can be grown to advantage. The superintendent is convinced that "agricultural schools can be made a success if we have men who know how to work, and will get right out and work with their own hands, as this teacher has done."

The superintendent of District No. 19, with headquarters at Bayamon, reports that "the agricultural school has continued its excellent work and rendered entire satisfaction." This school has given considerable attention to the beautification of the school grounds, in which work the girls have assisted.

Attention is also called to agricultural work inaugurated in a rural school in this district. The necessary tools were loaned by the Department of Education, while the Porto Rico Agricultural Experiment Station, at Mayaguez, furnished seed and many valuable suggestions as to planting and cultivating. Each boy was given a plat of ground and seed for planting. The experiment has proven a success in every way, fine crops of garden truck being grown. Five other schools have asked to enjoy the same privilege.

Agriculture in the Primary Schools of New Zealand.—The New Zealand department of agriculture is encouraging the introduction of agriculture into the primary schools of that country. The biologist of the department has been conducting experiments for several years in connection with the Mauriceville West Primary School in teaching the elements of agricultural science and school gardening. In his report on the school garden work, he says: "The time allotted to this work is 2 hours per week, and it has been found that not only does it not interfere with the effective teaching of other subjects, but it is actually an assistance, providing, as it does, additional subjects for composition exercises, increasing the pupils' powers of observation, and inculcating habits of neatness and methodical arrangement."

Kaerehave Agricultural School.—According to a note in the Journal of the Board of Agriculture for January, 1906, a school for the training and instructing of renters and laborers of both sexes was established near Ringsted, Denmark, with Government aid in November, 1903. The pupils are chiefly girls and farm hands, from 20 to 25 years of age, who attend from 5 months to a year, and older persons who attend the short courses of 11 days. During the time the school has been in operation, it has been attended by 375 pupils in long courses and 800 persons in short courses. The land for the school (54½ acres) was donated by the town of Ringsted. The department of agriculture granted a loan of $16,170 to aid in starting the school.

A New School of Agriculture in France.—A school of agriculture has recently been established at Hennebont (Morbihan), which is well equipped with land for demonstration purposes, orchards, domestic animals, and other agricultural material.

South African School of Forestry.—The government of Cape Colony is establishing the South African School of Forestry at Tokai, to provide a course of instruction for training young men for practical and scientific work in South African forestry. Provision is being made for 10 resident students at Tokai, who will be received from the South African College and other similarly equipped institutions in the colony after having completed the theoretical work in forestry.

Two New Veterinary Journals.—The great progress which has been made in recent years in the study of animal diseases in the Tropics has made it desirable to publish a periodical in which contributions relating to tropical diseases in various countries will be gathered together for the benefit of workers engaged in this line of investigation. It often happens that the library facilities for such workers in the tropical countries are not the best, and it is, therefore, especially desirable to get all the recent material in as available a form as possible.

The *Journal of Tropical Veterinary Science*, the first number of which has just been issued, seeks to supply this need. Attention is called, in an editorial note in the first number, to the fact that many of the tropical diseases in animals are infectious also for man, and more information is desired regarding the cause and control of these diseases both for the guidance of intending settlers in tropical countries and for the benefit of animal industry in those regions.

A new journal devoted to infectious diseases of animals and methods which contribute to the hygiene of farm animals (*Zeitschrift für Infectionskrankheiten para-*

sitäre Krankheiten und Hygiene) has recently appeared under the editorship of Dr. Robert Ostertag, of Berlin, and other collaborators. This journal is intended for use in the publication of original articles relating to bacterial and parasitic diseases of animals and general farm hygiene. The journal on meat and milk hygiene, published for many years under the editorship of Dr. Ostertag, was found to be quite satisfactory for the inclusion of articles relating strictly to these subjects, but a large mass of other material not dealing with the special topics of meat and milk inspection suggested the desirability of publishing the new journal to contain such material.

In addition to original articles the journal also contains general summaries of literature on special topics, and reviews of books and smaller articles dealing with bacterial diseases and the general problems of bacteriology in relation to pathology.

Miscellaneous.—*The Garden Album and Review* is the title of a new English monthly magazine of horticulture, edited by John Weathers, well known author of "A Practical Guide to Garden Plants," etc. A prominent feature of the new magazine will be 4 colored plates of plants, flowers, or fruits in each number. The magazine will be devoted to gardening interests in all of its branches, both open air and under glass. The first number contains 16 quarto pages and includes an index to the most important articles and illustrations in various other horticultural periodicals.

The *Monthly Weather Bulletin*, issued by the Weather Bureau of this Department, continues the series heretofore published under the title *Weather Crop Bulletin of the Weather Bureau.* It will hereafter be devoted to weather conditions.

The 25 county normal schools of Michigan will this year graduate 400 students for teachers in the rural schools. The expense to the State is said to be about $65 a teacher.

The annual meeting of the German Association of Naturalists and Physicians will be held this year at Stuttgart, September 16–22.

Joseph Pyro, professor of rural engineering in the School of Agriculture of Gembloux, Belgium, died at that place March 5, 1906. He was born at Liège November 28, 1843. Professor Pyro was a recognized authority in his chosen field and had achieved signal success in promoting education and investigation in rural engineering. He took a prominent part in the discussions of the International Congress of Agricultural Mechanics held at Liège in August, 1905.

Prof. Alexander Müller, agricultural chemist, died at Stensjoholm, Sweden, January 28, in his seventy-eighth year. He was appointed in 1856 director of the agricultural experimental section of the agricultural academy at Stockholm, and consulting agricultural adviser for Sweden and Norway. His earlier published work dealt mainly with questions of dairying, hygiene, and the treatment of soils; of late it related to the cleansing of towns.

Prof. N. Zuntz has been chosen rector of the agricultural high school at Berlin for the customary period of one year.

Dr. A. Backhaus, of Berlin, has been called to the organization and direction of an agricultural high school in connection with the University of Montevideo in Uruguay.

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EXPERIMENT STATION RECORD.

VOL. XVII. MAY, 1906. No. 9.

An important report upon the need of elementary training for the great productive industries has been presented to the Massachusetts legislature by a special commission, headed by President Carroll D. Wright as chairman. Agriculture is included among these industries, and definite provision is made for it in the general scheme by which the public-school system is to be enriched and expanded along industrial and vocational lines.

The commission has been engaged for some time in an investigation of the relation of the public schools to the various industries of the State, the preparation which the schools afford for the life work of the pupils, and the economic aspects of the question. It finds that the productive industries, including agriculture, manufactures, and building, depend mainly upon chance for recruiting their service. These industries are only touched educationally in their most advanced and scientific forms. No instruction whatever is furnished at public expense in the theory and practice of these occupations, and while agriculture is recognized by the State in its aid to the agricultural college, there is no preparatory work leading up to it in the same way that the high schools lead up to the other colleges. The same is true to a large extent of the schools of technology.

The children who leave school to enter employments at the age of 14 or 15 have had no training to develop their actual productive value or efficiency, and this is largely true of those who remain in school until 16 or 18. The added years, it is pointed out, are to a considerable extent lost time, so far as developing efficiency in productive employments is concerned. In the case of both classes of children the employment upon which they enter after leaving school is determined by chance.

These conditions, the commission holds, have an important economic bearing, for they tend to increase the cost of production, to limit the output in quantity, and to lower the grade in quality.

Industries so recruited can not long compete with similar industries recruited from the ranks of technically trained persons.

The commission concludes that the elements of industrial training, agriculture, domestic and mechanical sciences should be taught in the public schools, and it presents a strong argument in support of this conclusion. "The State needs a wider diffusion of industrial intelligence as a foundation for the highest technical success, and this can only be acquired in connection with the general system of education into which it should enter as an integral part from the beginning. The latest philosophy of education reinforces the demands of productive industry by showing that that which fits a child best for his place in the world as a producer tends to his own highest development physically, intellectually, and morally."

Two lines are suggested in which industrial education may be developed—through the existing public-school system and through independent industrial schools. It is recommended that cities and towns so modify the work in the elementary schools as to include instruction and practice in the elements of productive industry, as applied to agriculture and the mechanic and domestic arts, and "that this instruction be of such a character as to secure from it the highest cultural as well as the highest industrial value." It is also urged that the work in the high schools be so modified "that the instruction in mathematics, the sciences, and drawing shall show the application and use of these subjects in industrial life, with special reference to local industries; . . . that is, algebra and geometry should be so taught in the public schools as to show their relations to construction, botany to horticulture and agriculture, chemistry to agriculture, manufactures, and domestic science, and drawing to every form of industry."

In addition to these modifications the commission recommends that towns and cities provide new elective industrial courses in high schools, for instruction in the principles of agriculture and the domestic and mechanic arts, with both day and evening courses, so as to accommodate persons already employed in trades; and furthermore, that part-time day courses be provided for children between the ages of 14 and 18 years who are employed during the remainder of the day, so that instruction in the principles and the practice of the arts may go on together.

The above relates entirely to the existing public school system, whose integrity the scheme proposes to preserve. For the more technical and advanced work the commission believes that distinctive industrial schools, separated entirely from the public school system, should be maintained. This departure is held to be entirely in accord with the policy to which the State is already fully committed

through its support of normal schools, art schools, institutes of technology, and the agricultural college. In order to secure proper instruction for teachers in the elements of agriculture, it is suggested that a normal department be established in the State agricultural college, instead of attempting to introduce the subject into normal schools or establish a separate school for that purpose.

The recommendations of this commission are embodied in a bill submitted to the legislature, which provides for the appointment of a commission on industrial education to promote this work, and proposes State aid to towns and cities for the maintenance of distinctive schools for industrial training, or of industrial courses in high or manual training schools. The hearings on this bill before the legislative committees have attracted much attention, and developed widespread interest in favor of the measure.

The notable progress which has recently been made in the development of commercially successful methods of fixing the free nitrogen of the air, and thus making it available for agricultural and other industrial purposes, should go far toward reassuring those who are disposed to view with alarm the rapid exhaustion of the world's principal known supply of combined nitrogen, namely, the nitrate deposits.

The rapidly increasing demand (which has risen from less than 200,000 tons of nitrate in 1870 to over 1,500,000 tons in 1905) and the steadily diminishing supply have stimulated unusual activity in efforts to apply the discoveries of science to the solution of the great industrial problem of finding a practical means of maintaining a cheap and reliable supply of fixed nitrogen.

The encouraging results yielded by the Frank and Caro calcium cyanamid process have already been referred to (E. S. R., 15, p. 423). Further developments in the application of this process have fully justified the promise of the earlier trials, and factories have been built in Italy, Germany, and elsewhere to test the process on an extensive commercial basis. The numerous experiments which have been made to test the fertilizing value of the so-called lime nitrogen (*Kalkstickstoff*) prepared by this process indicate that when used with proper precautions and under certain restrictions the product has a fertilizing value in general but slightly inferior to that of nitrate of soda and somewhat superior to that of sulphate of ammonia. The results of hundreds of such experiments on a great variety of soils and crops are given in a recent 120-page report issued at Rome, which is briefly noted elsewhere.

Improvements are constantly being made which increase the efficiency of the process and lessen the cost of the product, and which encourage the belief that where cheap water power is available this

process can be made to yield a product capable of competing successfully with nitrate of soda in the markets of the world.

The most recent and most notable development in the line of fixation of the nitrogen of the air for commercial purposes is, however, in the nature of a return to the earlier methods of direct oxidation by means of electric discharges. Prof. K. Birkeland, of the University of Christiania, Norway, and S. Eyde, a Norwegian civil engineer, have devised a process for greatly increasing the size and efficiency of the ordinary electric arc, so that oxidation of the nitrogen is more rapid and is accomplished with much less expenditure of electric energy, and hence at less cost than in preceding processes.

A recent writer in describing the process says: "The inventors, instead of working with arcs of the lowest possible amperage, make the first technical application of a phenomenon previously known to physicists, the action of the magnetic field on the arc." They use a powerful current of electricity in the form of great glowing electric disks, up to 6 feet in diameter, which are built up of arcs deflected by powerful magnets.

By means of powerful electromagnets placed vertically to the electrodes, which are hollow and cooled with a stream of water, "the arc formed between the electrodes is blown away, as it were, by the influence of the magnetic field, and at once a new arc is formed, which is blown away. This process can be repeated 1,000 times a second, though in practice only a few hundred arcs per second are used. With alternating current arcs and direct current magnetic field, or vice versa, the arcs vibrate between the electrodes as circular disks." There is thus secured the alternate heating (to 2,000° C.) and cooling, and the rapid and thorough contact of the air with the most active zone of the arc, which are essential to the highest oxidation efficiency.

The efficiency of this process has been demonstrated in an experimental factory near Notodden, Norway, which utilizes the unusually cheap water power of that region for the production of the electrical energy required. It is reported that the daily output of this factory for the year during which it has been in operation is about 3,300 pounds of pure nitric acid, and the factory has been pronounced a technical and financial success by the eminent authority, Otto N. Witt, of Berlin. The success of the experimental factory has been such that several larger establishments are being built at other places in south Norway where cheap water power can be had. It is claimed that these factories will utilize in the aggregate about 30,000 horsepower, and that the company exploiting the patent has options on Norwegian waterfalls capable of yielding 350,000 horsepower at very low cost.

It is reported that nitric acid can be produced by this process at less than one-tenth of its present cost. Owing, however, to the dilution of the products of oxidation the difficulty and expense is less in

production than in concentration of the nitric acid. The latter has not yet found a perfect technical solution, and so it has been found most economical to market the product in form of calcium nitrate.

For agricultural purposes especially the calcium nitrate is mixed with an excess of lime, yielding a dry, easily handled material known commercially as "lime niter" (*Kalksalpeter*), which contains on an average 8 to 9 per cent of nitrogen and about 22 per cent of lime. A number of experiments have been made with this material which indicate that it has a fertilizing value slightly superior to nitrate of soda on soils benefited by lime as well as nitrogen.

In a recent article reviewing two important contributions to the subject of fixation of atmospheric nitrogen, E. Renouf enumerates and discusses the relative efficiency of no less than four distinct methods of accomplishing this result, viz, fixation by means of micro-organisms, formation and decomposition of nitrids, the production of calcium cyanamid, and electrical oxidation; and expresses the conviction that "by the time the Chili saltpeter beds are exhausted chemists and engineers will be ready with practical and economic methods of utilizing atmospheric nitrogen to meet the demands of agriculture and industry."

The products of the various processes for fixing the nitrogen of the air have not yet found their way into markets in sufficient quantity to establish their commercial rating, but Prof. Silvanus P. Thompson, the eminent English physicist, in a recent lecture before the Royal Institution of London, asserts his belief that where conditions are exceptionally good for the furnishing of power at exceedingly low rates, nitrogen compounds can be prepared by the Birkeland and Eyde process at a price which will enable them to compete with nitrate of soda in the market, becoming every year more valuable as the demand for nitrates increases and the natural supply becomes exhausted.

The development of these methods, while of great practical importance, is also of the highest significance as an illustration of the successful application of the results of investigations in pure science to practical affairs and commercial needs. The working out of these methods on a practical basis is rendered possible only because of the long series of scientific investigations beginning with Cavendish and continued by his successors in similar lines of work, which were undertaken solely for the purpose of advancing chemistry and physics as pure sciences and with no thought of practical results or commercial rewards.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The permanent committee on the analysis and control of agricultural products, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 4, pp. 101, 102*).—The duties of this committee, consisting of 32 members (including some of the most eminent scientific men of France), appointed by the minister of agriculture December 15, 1905, under the provision of a law of France of August 1, 1905, for the repression of fraud in foods, feeding stuffs, seeds, fertilizers, and agricultural products in general, are explained.[a] The committee has organized into a number of subcommittees for the consideration of different phases of its work.

Methods of analysis of fertilizers in different countries, L. SICARD (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1906), No. 3, pp. 204–222*).—This is the third report on this subject, and deals with methods of determining potash, describing the various methods which have been proposed for this purpose. The decisions of the Fifth International Congress of Applied Chemistry with relation to the analysis of nitrates are also given.

On the importance of uniform international methods of analysis, H. NISSENSON (*Chem. Ztg., 30 (1906), No. 3, pp. 16, 17*).—A number of illustrations of the need of such methods are cited.

New method for the determination of atmospheric carbon dioxid, based on the rate of its absorption by a free surface of a solution of an alkali hydroxid, H. T. BROWN and F. ESCOMBE (*Proc. Roy. Soc. [London], Ser. B, 76 (1905), No. B507, pp. 112–117; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 518, II, p. 858*).—The method proposed is based upon the fact that when a current of air containing a constant proportion of carbon dioxid is drawn over the free surface of a solution of sodium hydroxid the rate of absorption increases with the velocity of the current up to a certain point, beyond which it remains constant. Furthermore, the rate of absorption is proportional to the partial pressure of the carbon dioxid within fairly wide limits.

In the method described the air is aspirated through the apparatus at a rate greater than that required for maximum absorption, and being drawn through a perforated plate is made to impinge in a turbulent stream on the surface of a standardized solution of sodium hydroxid, which is titrated after the experiment. A constant for the apparatus having been determined in a preliminary experiment, in which the air is measured, the proportion of carbon dioxid in a

[a] For composition and duties of this commission and the law under which it was appointed, see also Jour. Agr. Prat., n. ser., 10 (1905), Nos. 32, p. 181; 52, p. 805.

sample of air can be calculated from the time during which the current has passed and the amount of gas absorbed, a correction being applied for the effect of change of temperature on the rate of absorption.

On the determination of carbon monoxid in the air by means of iodin anhybrid, ALBERT-LÉVY and A. PÉCOUL (*Compt. Rend. Acad. Sci.* [*Paris*], *142* (*1906*), *No. 3, p. 162; abs. in Rev. Sci.* [*Paris*], *5. ser., 5* (*1906*), *No. 4, p. 112*).—In the method proposed use is made of the fact that one part of carbon monoxid in 10,000,000 of air gives an intense coloration in chloroform containing the anhydrid as a result of the liberation of iodin. Acetylene of the same strength gives no coloration.

The determination of sulphuric acid in drinking water, F. RASCHIG (*Ztschr. Angew. Chem., 19* (*1906*), *No. 8, p. 334*).—In the method proposed ½ liter to 5 liters of water, according to the sulphuric acid content, is mixed with the twentieth part of its volume of concentrated benzidin solution, stirred, and allowed to stand 15 minutes. If no precipitate is formed, the water contains 1.5 mg. of sulphuric acid (SO_3) or less. If a precipitate forms, it is collected on a filter, washed, and titrated in the usual way with tenth-normal sodium hydroxid. One cc. of the hydroxid corresponds to 4 mg. of SO_3. A correction of 1.5 mg. must be added in each determination.

Field assay of water, M. O. LEIGHTON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 151, pp. 77, pls. 4, figs. 3*).—This paper describes and discusses methods which have for some time been successfully used in investigations carried on by the division of hydro-economics of the U. S. Geological Survey on the quality of water in various parts of the United States.

Methods of determining turbidity, color, total hardness, alkalinity, normal carbonates, bicarbonates, total sulphates, chlorin, or total chlorids, iron, and calcium are discussed. Only such methods are described as are considered necessary for the determination of the ingredients which give waters their essential characteristics, and these are confined to simple and cheap methods useful for practical purposes and easily carried out in the field, but of little or no value from a purely scientific standpoint.

On the theory of the formation of potash deposits from sea water, E. JÄNECKE (*Ztschr. Angew. Chem., 19* (*1906*), *No. 1, pp. 7–14, figs. 8*).—A discussion of the physico-chemical theory of the formation of oceanic salt deposits as enunciated by Van't Hoff.

Colorimetric, turbidity, and titration methods used in soil investigations, O. SCHREINER and G. H. FAILYER (*U. S. Dept. Agr., Bur. Soils Bul. 31, pp. 60, pl. 1, figs. 5*).—The methods which have been used in the investigations of the Bureau of Soils and others which are applicable to similar work are concisely described in this bulletin "for the convenience of those desirous of continuing these investigations or of carrying on new lines of inquiry."

After a preliminary explanation of methods of preparing solutions from moist and dry soils, the construction and operation of the Briggs filtering apparatus (E. S. R., 14, p. 126), the decolorizing of soil solutions, the use of centrifugal and other methods of obtaining soil solutions devised by Briggs, McLane, and McCall (E. S. R., 16, p. 450), the preparation and decolorization of solutions from green and dried plants, the general principles and purposes of colorimetric, turbidity, and titration methods, and the construction and use of colorimeters, especially that of Schreiner,[a] the authors describe in detail the following methods: Colorimetric methods—ammonium, Nessler; potassium, Cameron and Failyer (E. S. R., 15, p. 444) and Hill (E. S. R., 15, p. 224);

[a] Jour. Amer. Chem. Soc., 27 (1905), pp. 1192–1203.

magnesium, Schreiner and Ferris;[a] manganese, Clennell; iron, Thomson's, as described by Sutton; titanium, Weller; nitrate, Gill (E. S. R., 6, p. 189); nitrite, Hosvay's modification of Griess's test; phosphate, Schreiner and Brown (E. S. R., 16, p. 533), and Woodman and Cayvan and Veitch (E. S. R., 13, p. 319; 14, pp. 125, 833); silica, Veitch and Schreiner (E. S. R., 14, p. 833; 15, p. 444); silica and phosphate combined, Schreiner (E. S. R., 15, p. 444); sulphate and sulphid, Winkler;[b] turbidity methods—calcium, Ferris's modification of Hinds (E. S. R., 8, p. 286); sulphate, Belz's modification of Hinds and Jackson; chlorid, Richards and Wells;[c] titration methods—calcium and magnesium, Winkler's modification of Clarke's soap method;[d] carbonate and bicarbonate, Cameron (E. S. R., 13, p. 428); chlorid, the standard silver nitrate and potassium chromate method.

On the determination of nitric acid in soils, BUHLERT and FICKENDEY (*Landw. Vers. Stat., 63 (1905), No. 3-4, pp. 239-246*).—The following method, based upon the results of studies of various factors affecting the accuracy of the determination of nitric acid in soils, is proposed:

Two kg. of the fresh sample of soil taken from a large number of places in a field and thoroughly mixed is shaken up immediately with 2 to 3 liters of water, shaking for ½ minute at intervals of 5 minutes. At the end of not more than 30 minutes the solution is allowed to settle somewhat and is filtered through a folded filter. Four hundred to 500 cc. of the filtrate is evaporated with the addition of a few drops of sodium hydroxid solution and analyzed by the Schloesing method. Very cloudy solutions are cleared by addition of 2 per cent sodium chlorid solution.

On the determination of aluminum, H. WEBER (*Ztschr. Analyt. Chem., 44 (1905), No. 12, pp. 769-776*).—This is a review of recent literature relating to this subject.

Examination of foods, condiments, and commercial products, M. MANSFELD (*Die Untersuchung der Nahrungs- und Genussmittel sowie einiger Gebrauchsgegenstände. Leipsic and Vienna: Franz Deuticke, 1905, pp. XV+243, figs. 35; rev. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 12, pp. 766, 767*).—In this, the second edition, chapters on meat products and compressed yeast have been added and the whole book has been revised.

The proportion of glutaminic acid yielded by various vegetable proteins when decomposed by boiling with hydrochloric acid, T. B. OSBORNE and R. D. GILBERT (*Amer. Jour. Physiol., 15 (1906), No. 4, pp. 333-356*).—The proteids studied were obtained from cereals, legumes, oil-bearing seeds, and meat, fish, milk, and eggs.

In the case of the vegetable proteids the smallest amount of glutaminic acid 5.72 per cent, was obtained from the leucosin of wheat and the largest amount, 37.17 per cent, from the gliadin of wheat. "The proteins of the cereals yield much more glutaminic acid than do any of the other groups, for, omitting leucosin, which is present in the wheat kernel only in very small proportion and confined chiefly to the embryo of the seed, the average yield of this acid was 29.5 per cent, while the legumes yielded 19.6 per cent, the oil seeds 16.8 per cent, and the 3 animal proteins 8.9 per cent. . . . It would appear that such animal proteins as have been carefully investigated yield similar proportions of glutaminic acid, namely, about 8 to 11 per cent.

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[a] Jour. Amer. Chem. Soc., 20 (1904), pp. 961-967.
[b] Ztschr. Anal. Chem., 40 (1901), pp. 465, 772.
[c] Jour. Amer. Chem. Soc., 27 (1905), p. 459.
[d] Ztschr. Anal. Chem., 40 (1901), p. 82.

"In view of the wide differences in the constitution of the proteins of the different species of seeds, as shown by the determinations of glutaminic acid given in this paper, as well as by the few quantitative determinations of the other decomposition products which have been made, it would seem important to know definitely whether or not similar differences exist between the proteins of the tissues of different species of animals which serve as food for man, for it is possible that in such differences will be found a logical basis for the use of one form of protein rather than another when dealing with nutrition in various pathological conditions."

The authors propose to continue their investigations.

Concerning the detection of boric acid, G. Fendler (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 3, pp. 137–144*).—A method of estimating boric acid is described which depends upon comparing the intensity of the curcuma paper reaction with a color scale made by immersing strips of curcuma paper for different lengths of time in different solutions of boric acid of known strength.

The sensitiveness of curcuma paper for boric acid reaction, L. Wolfrum and J. Pinnow (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 3, pp. 144–154*).—Different sorts of commercial curcuma paper were compared.

The estimation of sulphurous acid in certain foods and also the estimation of sulphur in illuminating gas, T. Schumacher and E. Feder (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 11, pp. 649–659, fig. 1*).—The method described depends upon the distillation of an acidulated portion of the substance to be examined with a solution of iodate of potassium.

The detection of talc and coloring matter in grits and rice, E. von Raumer (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 12, pp. 744–746*).—It has been found that coloring matters and talc are easily separated with chloroform. The author describes a method of estimating talc which depends upon shaking the sample with chloroform and evaporating to dryness.

The occurrence of cholesterin and lecithin in milk and their importance in the determination of fat by the Gottlieb method, M. Siegfeld (*Milchw. Zentbl., 2 (1906), No. 1, pp. 1–5*).—Fat determinations by the Gottlieb method were found to be 0.0243 per cent too high, due to the presence of 0.0041 per cent of ether-insoluble material, 0.0036 per cent of unsaponifiable material, and 0.0166 per cent of lecithin in the solids obtained by this method.

On the accuracy of the Wollny refractometer, the Gottlieb method, and the Gerber acid butyrometer for the determination of fat, H. Schrott-Fiechtl (*Milchw. Zentbl., 2 (1906), No. 1, pp. 13–19*).—The Gottlieb-Röse method is considered the most accurate gravimetric method for the determination of fat in milk. The average of 100 determinations by this method was 2.2849 per cent and by the refractometer method 2.2755 per cent. A similar comparison of the Gerber and Wollny methods gave average results of 3.7252 and 3.7210 per cent, respectively.

New nonacid method for the rapid determination of fat in milk, N. Gerber (*Milch Ztg., 35 (1906), No. 4, pp. 37, 38*).—Comparative tests of the Sichler and Gerber methods are reported and the conclusion is drawn that there is no reason for abandoning the Gerber method in favor of the nonacid method.

Formalin as a means of preventing plugging in the determination of fat in the Gerber butyrometer, C. Beger, (*Milchw. Zentbl., 2 (1906), No. 1, pp. 6–8*).—This trouble, according to the author, may be avoided by the addition of 1 drop of formalin per cubic centimeter of amyl alcohol and the accuracy of the test not interfered with.

The determination of the fat content of butter, H. Lührig (*Molk. Ztg., 19 (1905), No. 48, pp. 1217, 1218*).—The author tested the method of E. Von Waegenigh.

In this 1 gm. of butter is shaken with 20 cc. of ether, and 0.5 gm. of powdered tragacanth and 2.5 cc. of water are added to the mixture, which is then centrifuged for 2 to 3 minutes. The ether layer containing the fat is separated, the ether evaporated, and the fat weighed. The tragacanth is added for the purpose of removing the water, proteids, milk sugar, and salt from the fat. The method was found to be rapid, but not very accurate. It is considered worthy of further study.

New method for the detection of cocoanut oil in butter, U. P. Wijsman and Reijst (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 5, pp. 267–271; Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 5, pp. 491–498*).—This method is based upon the precipitation of volatile fatty acids by silver nitrate.

To the filtered and neutralized distillate obtained in the Reichert-Meissl method is added 40 cc. ot a decinormal solution of silver nitrate. This is filtered and the precipitate washed until about 200 cc. of liquid is obtained, to which is added 50 cc. of decinormal solution of sodium chlorid. The excess of sodium chlorid is determined by titration with decinormal silver nitrate, potassium chromate being used as an indicator. The difference between the total number of cubic centimeters of silver nitrate employed and the number of cubic centimeters of sodium chlorid increased by 0.1 is called the first silver index.

A second silver index is obtained by using 300 cc. of distillate from the Reichert-Meissl method instead of 110, adding 40 cc. of a decinormal silver nitrate to 250 cc of this liquid, filtering and washing until 350 cc. of liquid is obtained. The number obtained as above is increased by one-fifth. The presence of cocoanut oil is indicated by an increase in the second silver index over the first.

On the value of Schiff's reagent for the detection of formaldehyde in milk, Utz (*Milchw. Zentbl., 2 (1906), No. 1, pp. 12, 13*).—The author concludes, as the result of his investigations, that this reagent is not to be recommended for the detection of formaldehyde in milk, and that the best method for this purpose is that of Arnold and Mentzel (E. S. R., 13, p. 1015).

The relation of cows' milk to Schiff's reagent and a test for formalin in milk, Eichholz (*Milchw. Zentbl., 1 (1905), No. 11, pp. 499, 500*).—This is a criticism of the article by Seligmann previously noted (E. S. R., 16, p. 742).

Separation of nitrogenous bodies in cheese, R. Harcourt (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 70–76*).—This report was presented at the last meeting of the Association of Official Agricultural Chemists (E. S. R., 17, p. 432).

Extracts from the proceedings of the Association of Official Agricultural Chemists, 1905, edited by H. W. Wiley (*U. S. Dept. Agr., Bur. Chem. Circ. 26, pp. 16*).—This gives the recommendations of referees as adopted, motions, and appointments affecting the work of the association for 1906. A summarized account of the proceedings of this association in 1905 was given in a previous number of the Record (E. S. R., 17, p. 423).

Agricultural chemistry, A. Morgen and W. Zielstorff (*Jahrb. Chem., 14 (1904), pp. 286–303*).—This is a brief review of progress during 1904 in investigations relating to air and water, soils, fertilizers, plant physiology, and animal physiology, including also biographical and miscellaneous notes.

Text-book of meteorology, J. HANN (*Lehrbuch der Meteorologie. Leipsic: H. Tauchnitz, 1905, 2. ed., pp. 642; rev. in Nature* [*London*], *73* (*1906*), *No. 1890, p. 270*).—The first edition of this work appeared in 1901 (E. S. R., 13, p. 923). In this second edition the volume of the book has been considerably reduced, many original references cut out and new ones added, and many parts thoroughly revised, as, for example, the section relating to meteorology of the upper air.

The study of meteorology, F. WALDO (*Education, 26* (*1905*), *No. 3, pp. 149–153*).—This is a brief review of progress which has been made in the United States in developing courses of instruction in meteorology, especially the work of Professor Davis at Harvard. The courses in meteorology given at that institution are described, as well as the opportunities for advanced work at the Harvard College Astronomical and Blue Hill observatories.

Recent advances in meteorology and meteorological service in Japan, S. T. TAMURA (*Pop. Sci. Mo., 68* (*1906*), *No. 2, pp. 139–144*).—A brief account is given of the organization, equipment, and work of the meteorological service of Japan, which was established in 1875, systematic meteorological observations having been made, however, as early as 1872 at the observatory at Hakodaté. The important contributions which Japanese meteorologists have made to practical and theoretical meteorology and the diffusion of such knowledge are considered in some detail.

Weather report, 1905, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31* (*1905*), *pp. 32, 33*).—Tabular statements are given of observations at Ontario Agricultural College and at various other points in Ontario on temperature and precipitation. The temperature and frost observations at Guelph during 1905 are compared with those of 6 preceding years. The mean temperature for 1905 was 43.6° F., the highest 89.06, in July, the lowest —15, in February; the last killing frost in spring April 24 (29.5°), the first in autumn September 26 (29°).

Meteorological observations, J. E. OSTRANDER, C. H. CHADWICK, and T. A. BARRY (*Massachusetts Sta. Met. Buls. 205, 206, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1906. The data are briefly discussed in a general note on the weather of each month.

Report of meteorologist, N. HELME (*Rhode Island Sta. Rpt. 1905, pp. 327–343*).—This includes general notes on the weather during the year ended June 30, 1905, and a tabulated record of observations at Kingston on temperature, precipitation, cloudiness, and prevailing winds during each month from July, 1904, to June, 1905, inclusive, with a summary for the year ended June 30, 1905. The latter summary is as follows:

Temperature (degrees F.).—Maximum, 87, July 19, 1904; minimum, —4, February 4, 1905; mean, 45.3; highest monthly mean, 68.3, July, 1904; lowest monthly mean, 21, February, 1905; highest daily mean, 75, July 19 and 20, 1904; lowest daily mean, 7.5, February 4, 1905. *Precipitation* (inches).—Total (rain and melted snow), 41.64; greatest monthly, 7.63, August, 1904; least monthly, 1.69, May, 1905; greatest in 24 consecutive hours, 2.48, August 10, 1904; snowfall, total 51. *Weather*.—Number of clear days, 151; number of fair days, 122; number of cloudy days, 92; number of days on which there was precipitation of 0.01 in. or more, 99. *Prevailing wind*, southwest and west.

Meteorological data, H. L. PRICE (*Virginia Sta. Bul. 155, pp. 119–129, charts 5*).—A previous bulletin of the station (E. S. R., 11, p. 128) gave summaries of observations on temperature, precipitation, wind, cloudiness, etc., for the period 1893–1898, and charts showing variation in temperature and rainfall for the same period. This bulletin brings these observations and charts down to the end of 1904. The following summary for the period 1893–1904 is given:

"*Temperature.*—Mean annual, 51.5°; mean maximum, 63.22°; mean minimum, 40.04°; absolute maximum, 96°; absolute minimum, —13°. Dates when temperature fell to or below zero: January 10, 11, 15 and 16, 1893; December 29, 1894; January 12 and 13 and February 3, 6, 7, 8, 9 and 15, 1895; February 20 and 21, 1896; January 28 and 30, 1897; February 3 and 4, 1898; February 1, 9, 10, 11, 13 and 14, and December 31, 1899; February 1, and March 17 and 18, 1900; December 16 and 21, 1901; February 19, 1903; January 30 and February 6, 1904. Dates when maximum temperature rose to or above 95°: August 10 and 11 and September 3 and 10, 1900; July 17, 1902.

"*Precipitation.*—Mean annual, 39.41 inches; spring, 10.22; summer, 12.57; fall, 7.50; winter, 9.12. Highest for month, August, 1901, 10.53; lowest for month, October, 1904, 0.13. Greatest depth of snow in 24 hours: 11 inches, January 9, 1895.

"*Frost.*—Average date of last killing frost in spring, April 25; average date of first killing frost in fall, September 30; date of latest killing frost recorded, May 13, 1895; date of earliest killing frost recorded, September 22, 1897."

Observations on the intensity and duration of rainfall, A. WOEIKOF (*Met. Ztschr., 23 (1906), No. 1, pp. 8–10*).—Four rainfall types are briefly described.

Rainfall per day and hour in Northwest England, A. WOEIKOF (*Met. Ztschr., 23 (1906), No. 1, pp. 6–8*).

Distribution of summer rains in Germany, E. LESS (*Met. Ztschr., 22 (1905), Nos. 11, pp. 496–505, figs. 4; 12, pp. 529–547, fig. 1*).—Rainfall movements are traced and the conditions (temperature, pressure, etc.) affecting them are discussed.

Estimation of the possible period of sunshine and its normal value for Germany, GROSSMANN (*Met. Ztschr., 22 (1905), No. 10, pp. 433–438*).

The relation of the temperature of the lowest layers of the air to that of the upper layers containing solid and liquid matter, A. WOEIKOF (*Met. Ztschr., 23 (1906), No. 1, pp. 1–6*).

Daily temperature periods in the lowest layer of the air, M. SASSENFELD (*Met. Ztschr., 23 (1906), No. 1, pp. 24–30*).—The periods are worked out for normal, clear, and cloudy days on the basis of observations at Potsdam.

On the importance of drainage for the elimination of danger from frost, L. LINDELÖF ET AL. (*Svenska Mosskulturför. Tidskr., 19 (1905), No. 5–6, pp. 495–513*).—A discussion of the subject by a committee of scientists appointed by the Finnish State Board of Agriculture.—F. W. WOLL.

International catalogue of scientific literature. F—Meteorology (*Internat. Cat. Sci. Lit., 3 (1905), Oct., pp. VIII+235*).—This is the third annual issue of this catalogue. The literature indexed is mainly that of 1903 and of the earlier part of 1904.

Lightning report, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 30–32*).—A statement is given of destruction and damage by lightning in Ontario during 1905 as compared with previous years. The data are tabulated with reference to trees, animals, and buildings struck.

Geology and water resources of Oklahoma, C. N. GOULD (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 148, pp. 178, pls. 22, figs. 32*).—This

paper deals with topography, geology, water supply (streams, springs, deep wells, and artesian wells), irrigation, climate, and water analyses. The water conditions of each county are separately discussed, and records of 10 wells from each of the 26 counties in the State are given.

Preliminary list of deep borings in the United States, N. H. DARTON (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 149, 2. ed., pp. 175+III*).—A table of borings more than 400 ft. in depth, giving location, depth, diameter, yield per minute, and height of water, with additional data where available, together with bibliographies of the subject by States.

Purification of waters for industrial purposes, D. PENIAKOFF (*Bul. Soc. Chim. Belg., 19 (1905), Nos. 5, pp. 122–136; 6, pp. 159–171*).—The author discusses in some detail and reports a large number of tests of the various chemical precipitation methods which have been proposed for this purpose. The results indicate that on the whole the use of aluminate of barium (Al_2BaO_4) gives the most satisfactory results.

The sterilization of water by means of ozone, E. PILATTE (*Rev. Sci. [Paris], 5. ser., 5 (1906), No. 2, pp. 37–43*).—This is an account of the application of Otto's method (E. S. R., 17, p. 642) to the water supply of Nice. It is claimed that the method gave satisfactory results and there appears to be no reason why the total water supply of the city, amounting to 22,500 cubic meters daily, should not be efficiently treated by the process.

Notes on water softening, W. M. GARDNER and L. L. LLOYD (*Jour. Soc. Chem. Indus., 24 (1905), No. 8, pp. 392–395; abs. in Engin. and Min. Jour., 80 (1905), No. 22, pp. 1021, 1022*).—This article deals with the influence on the softening process of the amount of neutral salts present and the method and apparatus used in carrying out the process.

It is claimed that the neutral salts always present to a more or less extent in water are more deleterious than is generally recognized, and their proportion may be notably increased by the use of sodium carbonate to remove hardness due to calcium. The influence of apparatus depends mainly upon the time allowed for the reactions to proceed and upon temperature as well as thoroughness of mixing. The Pfeifer and Wartha formulas for determining the amounts of reagents to be used in softening water (E. S. R., 15, p. 746) are considered unreliable when much neutral salts is present. The authors prefer to base the treatment upon direct determination of the lime and soda present. Methods of doing this are described.

The use of barium hydroxid as a softening reagent is referred to and the opinion is expressed that at its present price this material can be used only in special cases, and since barium compounds are reputed to be poisonous, it is obvious that the barium hydroxid should be used with great caution in the treatment of drinking water. "If the amount used is carefully regulated, however, to exclude the possibility of the presence of barium carbonate, not a trace of barium remains in solution."

Hints on water supply (*Jour. Bd. Agr. [London], 12 (1905), No. 3, pp. 144–149*).—Suggestions are made in this article regarding the development of underground supplies of water, especially in time of drought. The measurement of the flow of springs and streams is also described and means of filtering and purifying the water of surface streams and of collecting rain water are explained, as well as a method of calculating the available supply of wells.

The sanitary protection of water supplies, K. ALLEN (*Jour. Franklin Inst., 160 (1905), No. 4, pp. 297–323*).—In this paper it is pointed out that unsanitary conditions may be detected by analysis of the water, by inspection of watersheds, or by mortality statistics.

Knowledge of the life history of the typhoid germ and registration of vital statistics are important, and presumptive tests for *Bacillus coli communis* are considered valuable. In the author's opinion corrective treatment may be applied by the individual but should be applied to the entire supply. It may consist in (1) prevention of pollution, (2) adoption of a pure supply, (3) purification of an inferior supply. Control by boards of health, with Federal control as a last resort, is suggested. In any case ample power and funds should be provided.

In selecting method of securing pure water with limited resources it is inadvisable to strive for ideal results in some detail at expense of greater general benefit.

The sanitary value of a water analysis, L. P. KINNICUTT (*Science, n. ser., 23 (1906), No. 576, pp. 56–66*).—The substance of this paper has been noted from another source (E. S. R., 17, p. 611).

On the detection of fecal contamination of drinking water, CHRISTIAN (*Arch. Hyg., 54 (1905), No. 4, pp. 386–395*).—After briefly reviewing the literature bearing directly upon this subject, the author reports tests of Eijkmann's method,[a] which is based upon the ability of colon bacilli to grow at 46° C. By varying the temperature it was found that certain organisms of the coli groups derived from cold-blooded animals were active at 37° but not at 46°. In case of the organisms derived from warm-blooded animals, however, there was growth at 46° C.

Sewerage and sewage purification, M. N. BAKER (*New York: D. Van Nostrand Co., 1905; rev. in Jour. Amer. Chem. Soc., 27 (1905), No. 12, p. 1573*).—This is a second edition of this book, which was first published in 1895. The part which treats of sewage purification has been almost entirely rewritten and embodies the advances in methods which have been made in this country and in England in recent years, including discussions of treatment of sewage by intermittent filtration beds, septic tanks, contact beds, and percolating filters.

A review of the laws forbidding pollution of inland waters in the United States, E. B. GOODELL (*U. S. Geol. Survey, Water-Supply and Irrig. Paper No. 152, pp. 149*).—This is a second revised edition of Water-Supply and Irrigation Paper No. 103 (E. S. R., 16, p. 721).

SOILS—FERTILIZERS.

Treatise on soils for farmers and foresters, E. A. MITSCHERLICH (*Bodenkunde fur Land- und Forstwirte. Berlin: Paul Parey, 1905, pp. VIII+364, figs. 38*).—This book treats the subject of soils, as they occur in nature, solely from the physical and chemical standpoints without reference to geological origin or previous history, the author taking the position that the only connecting link between geological and physiological soil knowledge is that furnished by the fundamental sciences—physics and chemistry.

Accordingly, after a brief introduction defining the word soil and discussing the value of soils and the purpose of soil investigation, the book proceeds at once to the consideration of (1) the physical nature of soil samples, (2) the chemical nature of soil samples, and (3) soils in place.

The first part includes specific characteristic of the solid soil particles, the relation of these particles to one another and to the volume of space in soil, soil water and its relation to the solid soil particles, soil atmosphere and its relation to soil water and to the solid soil particles, and the relation of soils to heat.

[a] Centbl. Bakt. [etc.], 1. Abt., Orig., 37 (1904), No. 5, p. 742.

The second part discusses the general chemical properties of soils and chemical analysis of soils. The third part deals with the properties of soils in place and their variation under natural conditions, and classification of soils.

The attempt has been made to incorporate in the treatise the more important results of previous investigations (mainly German and French) on the physics and chemistry of soils, including those of the author, especially the application of his method of determining the heat generated when soils are moistened (*Benetzungswärme*) in the study of the physical properties of soils (E. S. R., 13, p. 833; 14, p. 127; 17, p. 745).

Classification and nomenclature of cultivated soils, H. LAGATU (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1906), No. 3, pp. 193–204, figs. 3*).—This article consists of reprints of 3 shorter articles which have already been noted from another source (E. S. R., 17, pp. 113, 226).

The soil survey of Illinois, C. H. OATHOUT (*Ill. Agr., 10 (1905), No. 4, pp. 105–107*).—A brief account is given of the soil survey of the State, begun in cooperation with the Bureau of Soils of this Department and recently continued independently by the station. The methods pursued in making surveys, collecting and examining the samples, and in testing typical areas by means of plat experiments are described.

Soils of the Bahama Islands, C. N. MOONEY (*Separate from The Bahama Islands. New York and London: The Macmillan Co., 1905, pp. 147–181, pls. 8*).—This is an account of a reconnaissance and survey of the soils of these islands under the auspices of the Geographical Society of Baltimore. "The area surveyed and mapped amounted in all to about 700 square miles, and included five islands and a few small cays, viz: New Providence, Eleuthera, Cat, Long and Watlings islands, and Rum Cay and the cays adjacent to New Providence and Eleuthera."

The report discusses the agricultural development, climate, geology, soil types, methods of cultivating and cropping, and important crop and soil problems.

"As the geological formation and physiographic features of all the islands are the same, a great diversity of soil types is not found. In all 7 types of soil are recognized, as follows: Coral sands, Bahama black loam, Bahama sandy loam, Bahama red loam, Bahama marl, brackish swamp, and Bahama white marl." These 7 types are described in detail. Accompanying the descriptions of each type are mechanical analyses made by the method of the Bureau of Soils of this Department and chemical analyses made by the methods of the Association of Official Agricultural Chemists. Analyses of the water-soluble salts by methods proposed by the Bureau of Soils are also given.

With the exception of the coral sand, which occupies a narrow strip along the coast, the soils of the islands are generally of a rocky character, underlaid at a variable but generally slight depth by coralline limestone. The Bahama black loam, which is known as "provision land," and varies from a loose brown to a jet black loam consisting of rounded grains of coral sand with a large percentage of organic matter, is the principal type on the islands, occupying approximately three-fourths of their area. The soils as a rule are well supplied with plant food, in many cases being very rich. The agriculture of the islands, however, is in a depressed condition.

The soils of the Rhenish Palatinate and their relation to geological formations, E. BLANCK (*Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 3, pp. 419–447*).—The mineralogical and chemical properties of the rocks from which these soils are derived and the varying characteristics of the soils derived from their disintegration are discussed, the chemistry of the weathering processes receiving especial attention.

The soil of Gascony, L. A. FABRE (*Géographie, 11 (1905), Nos. 4, pp. 257–284, figs. 6; 5, pp. 343–358, figs. 3; 6, pp. 413–434, figs. 3*).—This deals with topography, geological origin and formations, the Gascon régime (including meteorology, etc.), geographical conditions, morphological evolution, coal deposits and their physiological relations, and economic and sociological conclusions with reference to the protection of the mountain soils.

Some observations on humus soils, G. SALOMONE (*Staz. Sper. Agr. Ital., 38 (1905), No. 7–8, pp. 696–704; abs. in Chem. Centbl., 1905, II, No. 26, p. 1819*).—The formation of humus out of plant remains is described and the composition of humus soils made with leaves of various kinds of trees is given.

Marsh soils, F. SCHUCHT (*Jour. Landw., 53 (1905), No. 4, pp. 309–328; abs. in Chem. Centbl., 1906, I, No. 1, p. 71*).—The results are given of mechanical and chemical studies of a large number of marsh soils with reference to the present character and the changes which the soils have undergone under the influence of weathering. The conclusion is reached that calcium carbonate is the constituent of marsh soils which gives the most reliable indication of the stage of weathering which the soils have undergone. It is possible by means of a study of the extent to which this constituent has been removed to approximate the geological age of the marsh.

Swamp soils, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 82–86*).—This is a brief discussion of the origin and properties of such soils based upon investigations carried on by the author during the past 3 years.

The effect of different soils upon the composition of crops, W. P. GAMBLE (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 93–100*).—The ash constituents of oats grown in pots filled with surface soil and under normal conditions on a field plat are compared, and the results are summarized as follows:

"(1) The largest percentage of mineral constituents (ash) was found in the oats grown upon the surface soil. Two reasons are given for this increase—(*a*) the supply of moisture was perhaps more uniform with the pot-grown plants, and (*b*) the soil in the cans was freely exposed to the heat of the sun, and more plant food was thereby made available.

"(2) There was a higher percentage of silica in the pot-grown oats than in the field-grown grain. According to some experiments that have been conducted to ascertain the function of silica, it does not appear to be essential for growth and proper development. Large quantities, however, are used by some plants.

"(3) Phosphoric acid, one of the most important constituents of plants, is found in larger quantities in the field samples. Calcium and magnesium may also be noted in the same connection. The subsoil may have influenced this increase.

"(4) The pot-grown plants contain the largest proportion of potash. The percentage of potash is much higher in the straw than in the grain, while with phosphoric acid the opposite is the case."

Physical analysis of soils, J. B. REYNOLDS (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31, (1905), pp. 27–29.*)—The general physical properties of soils are briefly discussed in this article and the principal results of physical analysis of 42 samples of soil from the Abitibi district of Canada are summarized.

About 5 per cent of the soils analyzed seemed to be composed entirely of clay with little or no admixture of coarse particles, 39 per cent contained from 15 to 25 per cent of coarse or fine quartz particles, and 19 per cent from 25 to 40 per cent of sand and silt. Fifteen per cent of the samples were classed as

loam, 7 per cent as sandy loam, 5 per cent as light sandy loam, and the remainder were peat soils.

A preliminary examination of about 40 samples of soil from the Temiskaming district indicate that these soils are quite similar in physical structure and appearance to the Abitibi soils.

Experiments on peat soil, W. H. DAY (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 35–37*).—Studies of the capillary rise of water in a peat soil which in its natural state baked and cracked in dry weather and absorbed water badly are reported.

The studies were made in tubes with the loose and packed soil and with mixtures of the soil with sand, loam, marl, and lime. "Twenty-five per cent loam, 10 per cent marl, and 50 per cent sand increased the capillary rate by about 25 per cent, as compared with the rate in pure peat, so that soil treated in any of these ways is capable of supplying water to the plants much more rapidly than in the untreated state. Ten per cent lime, on the other hand, decreased the capillary rate by about 50 per cent as compared with pure peat."

The tubes in which the water rose highest did not contain as much water per cubic centimeter of soil as those in which the water rose more slowly. This was especially true of the soil mixed with 10 per cent lime.

Experiments made with oats grown on the soil in crocks showed that the strongest and most uniform growth, least affected by "damping off," was obtained in the mixture containing 25 per cent of loam.

The results in general show that "the peat can be much improved by adding either loam or sand, but seriously injured by 10 per cent of lime. . . . Twenty-five per cent loam and 20 per cent sand seem to be the best treatments tested."

Experiments on aeration, W. H. DAY (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 37–40, figs. 3*).—In these experiments wheat, barley, oats, and peas were grown on loam soil in 4-gal. jars, fitted with tubes at the bottom, which permitted air to be drawn through the soil. "Once each day during the growing season air was drawn through half the crocks of each kind of grain, enough to completely change the air in the crocks. Observations were taken on the germination, the growth of the plants, the yield, the rainfall, and the water added."

The results with the cereals were vitiated by depredations of sparrows, but "point to the importance in the case of legumes (peas) of having the soil thoroughly loosened up so as to permit thorough aeration to begin with, and the free entrance of air afterwards."

Experiments on evaporation and transpiration, W. H. DAY (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 40–42*).—Studies of the amount of water required during the season by wheat, barley, oats, and peas growing in 4.-gal. crocks are reported.

From the data given it appears "that the wheat up to August 3, when it was about ripe, had used 2.15 times as much water as the rain that had fallen. The barley to July 20, 2.25 times as much water as had fallen, and the oats during the same period 2.57 times the amount of rain. The peas up to August 15 had used 2.19 times the rain during that period. Hence, in case of these four grains much more water for the sustenance of the crop must come from the store held in the earth from the winter and spring rains than from the summer rains." The wheat required during the season 22.6 in. of water; the barley, 18.52 in.; oats, 21.15 in., and peas, 27.38 in.

The constitution of arable soil.—The soil of Ségala (Druelle) and the rocks from which it was derived, A. DEQAGE and H. LAGATU (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1905), No. 2, pp. 93–110*).—Detailed mineralogical examinations according to the authors' method, which has already been noted

(E. S. R., 16, p. 756), are reported. These show that the minerals in the soil are identical with those of the original rock from which it was derived, the only difference being that the crystals are entire in case of the rock and broken in case of the soil.

Soil builders at work, S. W. FLETCHER (*Country Life Amer., 9 (1906), No. 3, pp. 325–327, figs. 18*).—A popular discussion of the weathering of rocks; plants and animals as soil builders; and the action of ice, wind, and micro-organisms. Soil exhaustion as well as formation is considered.

Feldspar and mica as sources of potash, D. N. PRIANISHNIKOV (*Landw. Vers. Stat., 63 (1905), No. 1–2, pp. 151–156*).—Sand cultures with tobacco, buckwheat, flax, peas, sunflowers, and barley, in which these substances were used in fine-ground condition (less than 0.25 mm. in diameter) in connection with sodium nitrate, ammonium nitrate, ammonium sulphate, and calcium nitrate, are reported.

The results show that the orthoclase, even in large amounts, had very little effect on the growth of plants, either alone or in association with the other materials. Mica and apophyllite gave somewhat better results than the orthoclase. The associated salts therefore apparently did not exert the solvent effect which had been previously noted in the case of phosphates (E. S. R., 17, p. 538).

Investigations on the insoluble potassium compounds contained in humic substances, M. BERTHELOT (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 26, pp. 1182–1187; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 520, II, p. 117*).—In continuation of previous investigations[a] the author studied the double decomposition resulting from the action of the soluble alkaline salts of weak acids, such as the acetates of potassium and calcium, on wood charcoal exhausted of soluble compounds partly by treatment with pure water and partly by extraction with dilute hydrochloric acid.

The results indicate the presence in wood charcoal of compounds which in general behave toward the salts of potassium and calcium named like the humic acid artificially prepared from sugar. These compounds, however, are of two classes of unequal stability, one immediately destroyed by dilute hydrochloric acid, the other being more resistant to this reagent. The compounds are analogous in their properties and affinities to different artificial and natural silicates.

On the causes of unproductivity in a Rhode Island soil, H. J. WHEELER and J. F. BREAZEALE (*Rhode Island Sta. Rpt. 1905, pp. 286–323*).—This is an account of cooperative investigations between the Rhode Island Station and the Bureau of Soils of this Department, "to study the soluble toxic substances in a highly unproductive soil and also in soils in good tilth and of high productiveness."

The influence of the treatment of the extracts of such soils with nonnutritive solid materials and with certain soluble chemical substances (ferric hydrate, carbon black, calcium carbonate and sulphate, sodium chlorid, potassium sulphate, disodium phosphate, sodium nitrate, and pyrogallol) was studied by means of water cultures with wheat, both in the normal and treated extract. The conclusions reached are that the unproductiveness of the infertile Miami silt loam from the station farm is in some measure transmitted to the aqueous extract of the soil.

The beneficial effect of treatment of the extract with finely divided carbon black and ferric hydrate is taken "to indicate that the extract contained injurious bodies which were removed from or altered in the soil extract so as to become noninjurious, or partially so, by the action of the solids above named. Some evidence in the same direction is derived from the fact that treatment of

[a] Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 21, p. 793.

the extract with pyrogallol produced a gain in transpiration in all cases and in green weight in three of the five instances. This phenol can not be considered as a nutrient material, so that the conclusion is suggested that certain toxic substances present in the extract are acted on chemically by the pyrogallol and brought into a less injurious form. It is suggested that the beneficial action of calcium carbonate and calcium sulphate in these experiments may be in part of a similar nature.

"The soil extracts were unquestionably improved for the growth of wheat plants by the addition of considerable amounts of sodium nitrate, potassium sulphate, acid sodium phosphate, and in certain cases by sodium chlorid. . . . The question as to just how the salts acted in all particulars must be left an open one for the present.

"A comparison of the effects produced by the various treatments of the extract of the infertile soil with those produced by the same treatments upon extracts of two soils of the same farm which were in good condition for the growth of crops shows that none of the treatments produced nearly as good effects upon the extract of the good soil as upon that of the poor soil; yet treatment with carbon black and ferric hydrate in a few cases seemed to produce a small beneficial effect upon the extracts of the good soils, and these bodies were probably effective through the removal of injurious substances from the extract. Therefore it may be supposed that the toxic bodies which apparently exist in relatively large amounts in the extracts of the infertile soil may be present also to a slight extent in that of the good ones. . . . To attempt to claim from the data obtained that because these manurial substances are beneficial to soil extracts in other ways than through their nutritive effects, where such a possibility of action exists, and that hence they do not play the rôle of plant nutrients in the soil when added, is not intended, nor is it to be inferred. Neither is it questioned but that the so-called chemical manures do in most instances, where they are applied to the 'worn out' type of soils, exert a direct effect as nutrients upon the plants."

Soil inoculation with artificial cultures, M. Ferguson (*Virginia Sta. Bul. 159, pp. 81–96, figs. 3*).—This bulletin briefly reviews the history of investigation on this subject, including that of the Virginia Station begun in 1903, describes the author's methods of preparing and distributing the cultures (liquid cultures in sealed glass tubes with a time limit of life), and gives results of 344 tests of the material in different parts of the State. The conditions under which inoculation is likely to succeed or fail are stated.

Of the 344 persons who tried the cultures sent out by the station, 61 reported crop failures due to bad seed, bad season, or weeds and grass. Of the 283 remaining, 234, or 82 per cent, reported that the material was without doubt a success and that the crop was benefited by it. The reports of 27 showed that the soil already contained the proper bacteria and that the crop was not materially benefited by inoculation, and 22, or 8 per cent, did not observe any effect of the inoculation either by formation of nodules or increase in the crop.

The general conclusion is reached that inoculation can be successfully and profitably done when care is taken to observe proper methods, but a conservative course is recommended since "no amount of inoculation or anything else will make up for an imperfectly prepared seed bed, poor soil, bad season, and poor cultivation." It is not believed that the results obtained justify the paying of the large prices which have been asked for commercial cultures, and the station will continue to supply farmers of the State with cultures at a cost of 25 cts. per acre, provided the farmers will give the material a fair trial and report results.

Loss of nitrogen in putrefying peptone solutions. Bacteriological soil investigation, P. EHRENBERG (*Centbl. Bakt.* [*etc.*] *2. Abt., 15* (*1905*), *No. 4–6, pp. 154–164; abs. in Jour. Chem. Soc.* [*London*], *88* (*1905*), *No. 517, II, p. 750*).—The author calls attention to the fact that in determining the power of soils to produce putrefaction in peptone solutions it is necessary to make determinations with the whole contents of the flasks, thus avoiding filtration and the use of aliquot portions of the solution. The putrefying power of similar soils varies appreciably under different treatments. The loss of nitrogen occurring in putrefying peptone solutions inoculated with soil and then filtered is ascribed to absorption rather than biological fixation in the soil.

The absorptive power of soils for bone and mineral superphosphates, C. MONTANARI (*Chem. Ztg.*, *29* (*1905*), *No. 75, pp. 988, 989; abs. in Jour. Chem. Soc.* [*London*], *88* (*1905*), *No. 517, II, p. 759*).—The author briefly reports experiments carried out on kilogram lots of soils of different kinds treated in funnels with solutions of the different superphosphates, which indicate that the popular belief as to the greater activity of bone superphosphate is not supported by the facts. Apparently, however, the phosphoric acid of the mineral superphosphate was not quite so rapidly absorbed by the soils, although it is the author's opinion that the portion absorbed was more rapidly taken up by the plant roots.

On the effect of liming upon certain constituents of a soil, B. L. HARTWELL and J. W. KELLOGG (*Rhode Island Sta. Rpt. 1905, pp. 242–252*).—"Since 1893 two of the permanent experimental plats upon the station plain have received equal amounts of nitrogen annually in sulphate of ammonia, and two others in nitrate of soda. About 3.7 tons of air-slaked lime have been applied in all to one of the plats receiving sulphate of ammonia and to one of those receiving nitrate of soda. Equal amounts of muriate of potash and dissolved boneblack have been added annually to each plat."

Chemical studies of the influence of this treatment on the humus content and the composition (ash constituents) of the humus of the soil show that "the amount of humus is now less in the limed than in the unlimed plats. The amount of free humus is likewise less in the limed plats. A smaller part of the humus is present as free humus in the limed plats. The loss by igniting the oven-dry soil was somewhat less from the samples of the limed plats than from the unlimed ones.

"The total nitrogen in the limed plat to which nitrate of soda is applied is less than the amount common to the other three plats.

"In the case of the unlimed plats the one to which sulphate of ammonia has been added would require much more lime to neutralize it, according to the lime-water test, than the one which has received nitrate of soda. Upon the same basis, no further application of lime would be required for the limed plat to which nitrate of soda has been added, although the limed plat receiving sulphate of ammonia is still somewhat acid.

"Most of the ash left upon destroying the separated humus and free humus by ignition is composed of iron and aluminum oxids, phosphoric acid, and silica.

"In the case of the ash remaining from the free humus, that from the limed soils contained larger percentages of phosphoric acid and smaller percentages of silica than that from the unlimed soils.

"Surprisingly large amounts of iron were found in the ash left from the ignition of the humus and free humus. The iron in the ammoniacal solutions of humus could not be thrown out by certain of the ordinary precipitants.

"An artificial product made by precipitating the humus from an ammoniacal extract of leaf mold, by means of ferrous chlorid, contained in its oven-dry condition 11 per cent of ash, of which 83 per cent was ferric oxid, the remainder being phosphoric acid and silica."

Directions for liming (*Rev. Gén. Agron.*, *14* (*1905*), *No. 12*, *pp. 499–501*).—The rules formulated by the German Agricultural Society for this purpose are given.

Cultural management as applied to sewage irrigation at Paris, P. VINCEY (*Mém. Soc. Nat. Agr. France*, *141* (*1905*), *pp. 415–500*, *pl. 1*, *figs. 6*).—The theory of this method of sewage disposal is explained, the history of its use in disposing of the sewage of Paris is reviewed, and its efficiency and present status is discussed.

It is pointed out that the Paris system of sewage disposal has not yet been perfected so that it secures both perfect purification of the sewage and its complete utilization. While much has been done to introduce crop rotations, which secure a more complete and uniform utilization of the sewage throughout the year, the supply of sewage has grown so large that it is impossible to take care of it in winter, and even in summer it is often difficult to secure that intermittance of application which is essential to thorough purification. This is true in spite of the fact that the municipality has rapidly increased the area of its sewage farms.

The difficulties are increased in those cases in which the city does not own the land, but simply supplies the sewage to farmers and gardeners, as they are not willing to irrigate during the night except to a very limited extent in dry seasons. The present system is inadequate to dispose of the sewage of Paris, and so make it possible to suppress pollution of the Seine. It is claimed to be possible to so extend the present area and application as to dispose of 775,000 cubic meters of sewage per day, which will be amply sufficient.

Local fertilizer experiments in Malmöhus County, Sweden, 1904, G. NORDIN and M. WEIBULL (*Malmö. Läns K. Hushäll, Sällsk. Kvrtlsskr.*, *1905*, *No. 1*, *pp. 207–271*).—A brief account of the cooperative fertilizer trials conducted on a number of different farms under the auspices of the Malmöhus County Agricultural Society is given, and the following subjects are discussed at more length: The general effects of fertilizers as shown by experiments during recent years, analyses of lime and soil analyses in general, the after-effect of artificial fertilizers, experiments with calcium carbid, experiments with lime as a manure preservative, the influence of different fertilizers on the quality of root crops and experiments with oat sickness of soils.—F. W. WOLL.

Experiments with mineral fertilizers on the Krotkov estate, A. I. STEBUT (*Vyestnik Russ. Selsk. Khoz.*, *1904*, *Nos. 50*, *51*; *abs. in Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6* (*1905*), *No. 2*, *pp. 245–247*).—The relative efficiency of drill and broadcast application of fertilizers is discussed on the basis of fertilizer experiments carried on at the Krotkov estate.

It is claimed that in drill application the fertilizers are placed where they are exhausted in the early stages of growth of the plant, which is thus forced into vigorous development, causing it to make increased demands upon soil fertility during later periods of growth. Drill fertilizing, therefore, not only does not increase the supply of plant food in the soil or provide fully for the requirements of the plant, but results in actual soil exhaustion. For drill fertilizing to yield best results the whole soil should be well supplied with plant food, the fertilizers applied in the drill acting mainly as a stimulus to the plant.

In the early stages of plant growth fertilizers which have been applied broadcast act in much the same manner as fertilizers applied in the drill, but they continue to furnish plant food through a longer period, depending upon the character of the root growth of the plant. If the plant has a limited root system or the season is dry, so that plant food does not circulate freely in the

soil solutions, a considerable amount of the fertilizing material applied broadcast may not be utilized by the plant.—F. FIREMAN.

Report on commercial fertilizers, 1905, E. H. JENKINS and A. L. WINTON (*Connecticut State Sta. Rpt. 1905, pt. 1, pp. 9–106*).—This includes a statement of the duties of manufacturers and dealers and of the experiment station in connection with the inspection under the State fertilizer law, a list of firms licensed to deal in fertilizers in the State during 1905, notes on the methods followed in sampling and collecting fertilizers, a classification of the fertilizers analyzed, descriptions (with analyses) of fertilizing material furnishing nitrogen, phosphoric acid, and potash in fertilizers, and explanations regarding the valuation of fertilizers.

Tabulated analyses and valuations are given of 600 samples of fertilizing materials, including nitrate of soda, dried blood, cotton-seed meal, castor pomace, flaxseed meal, dissolved rock phosphate, charred bone, carbonate of potash, high-grade sulphate of potash, double sulphate of potash and magnesia, muriate of potash, kainit, saltpeter waste, bone manures, slaughterhouse tankage, dry ground fish, superphosphates with potash salts, nitrogenous superphosphates, special manures, home-mixed fertilizers, vegetable potash, cotton-hull ashes, wood ashes, limekiln ashes, garbage ashes, lime, South American guano, sweepings from a fertilizer factory, dust from wheat, pulverized sheep manure, rotted cotton-seed compost, dust from tobacco, and woolen carpet waste.

The cash retail cost per pound in Connecticut of nitrogen in raw materials during 1905 as shown in this report was, in nitrate of soda, highest 17.5, lowest 16.4, average 16.9 cts.; dried blood, average 21.9 cts.; cotton-seed meal, highest 20.6, lowest 14.2, average 16.4 cts.; castor pomace, highest 24.5, lowest 20.4, average 22.4 cts.; and flaxseed meal, average 21.9 cts.

The price of available phosphoric acid in form of dissolved rock phosphate was, highest 4.8, lowest 4.3, average 4.5 cts. per pound.

The price per pound of potash in raw materials was, in high-grade carbonate, highest 7.3, lowest 6.7, average 7.1 cts.; carbonate as "vegetable potash," highest 8.1, lowest 7.9, average 8 cts.; high-grade sulphate, highest 5.3, lowest 4.8, average 5 cts.; double sulphate, highest 5.9, lowest 4.9, average 5.3 cts.; muriate of potash, highest 4.5, lowest 4, average 4.25 cts.; saltpeter waste, average, 0.7 ct.; and kainit, average 4.7 cts.

The price of lime per 100 lbs. was, in wood ashes, average 34 cts.; limekiln ashes, highest 15, lowest 4.3; and ground slaked lime, average 85 cts.

Commercial fertilizers, P. EVANS (*Missouri Fruit Sta. Bul. 13, pp. 23, fig. 1*).—In this bulletin an attempt is made to give "such information pertaining to the use of fertilizers as may be of use to the general inquirer. The information offered, however, does not come from the results of actual experiments conducted at this station, but rather is a general summary of the subject."

Analyses and valuations of commercial fertilizers, J. P. STREET, W. P. ALLEN, and V. J. CARBERRY (*New Jersey Stas. Bul. 188, pp. 46*).—This is a second report on fertilizer inspection during 1905, the first being given in Bulletin 187 of the station (E. S. R., 17, p. 450).

The trade values of fertilizing ingredients for 1905 are discussed and the composition of standard materials supplying them, station valuations are compared with actual selling prices, suggestions made regarding the purchase of fertilizers, and results reported of examinations of 104 samples of standard unmixed materials, 11 home mixtures, 20 special mixtures, 380 complete fertilizers, and 29 miscellaneous materials. "With a few exceptions the analyses indicate that the materials were of good quality, although the usual wide variations are shown in the case of dried fish and tankage."

Report of analyses of samples of fertilizers collected by the [New York] commissioner of agriculture during 1905 (*New York State Sta. Bul. 272, pp. 403–470*).—This bulletin gives in tabular form without discussion of any kind the analyses of samples of fertilizers collected by the commissioner of agriculture during 1905 and transmitted by him for analysis to the director of the New York State Station.

Fertilizer analyses, fall season, 1904, to spring season, 1905, B. W. KILGORE (*Bul. N. C. Bd. Agr., 26 (1905), No. 7, pp. 77*).—The names and guaranteed composition of fertilizers registered for 1905, and analyses and valuations of 679 samples of commercial fertilizers and 108 samples of cotton-seed meal, examined during the fall of 1904 and spring of 1905, with explanations regarding terms used in fertilizer analyses, freight rates, valuation, etc.

Commercial fertilizers, W. W. MILLER and N. W. LORD (*Ann. Rpt. Ohio Bd. Agr., 59 (1904), pp. 250–317*).—This is a report of analyses of commercial fertilizers made by the State chemist and of certificates filed by manufacturers or general agents during the year 1904, with the text of the State fertilizer law.

Miscellaneous analyses, B. L. HARTWELL, J. W. KELLOGG, and M. STEEL (*Rhode Island Sta. Rpt. 1905, pp. 223–226*).—Analyses (in some cases partial) are reported of "hydrated" lime, muck (air dried), soot from soft coal, street sweepings, ashes of hospital refuse, wood ashes, coal ashes, sawdust ashes from machine shop, black bone, guano, acid phosphate (dissolved phosphate rock), floats (undissolved phosphate rock), finely ground bone, dissolved bone, star fish (air dried), dried blood, nitrate of soda, sulphate of ammonia, muriate of potash, high-grade muriate of potash, high-grade sulphate of potash, potassium carbonate, sodium chlorid (common salt), sodium carbonate, Rhode Island corn bran, and cotton-seed meal.

Night soil, A. GRAU (*Jour. Agr. Prat., n. ser., 10 (1905), No. 50, pp. 754, 755*).—This article discusses briefly the preparation, variation in composition, and use of this material.

The production of manure, green manuring, and the purchase of commercial fertilizers, F. AEREBOE (*Fühling's Landw. Ztg., 54 (1905), No. 19, pp. 633–639*).—A general discussion of this subject.

Significance of ashes as fertilizer, D. N. PRIANISHNIKOV (*Vyestnik Russ. Selsk. Khoz., 1904, No. 11; abs. in Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 1, p. 50*).—Ashes are usually valued mainly as a potash fertilizer, but, according to the author's experiments on sandy soils, it has been demonstrated that ashes not only appear as a rich potash fertilizer, but their phosphoric acid, even that insoluble in water, possesses a high degree of assimilability (higher than the phosphoric acid of bones and but slightly inferior to superphosphate). The application of too large amounts of ashes, however, leads to the formation of a crust and an alkaline reaction in the soil which is not desirable.—P. FIREMAN.

Transformations of sodium nitrate in the soil of sugar-beet plantations, J. STOKLASA (*Ztschr. Zuckerindus. Böhmen, 30 (1905), pp. 1–8; abs. in Jour. Soc. Chem. Indus., 24 (1905), No. 21, pp. 1118, 1119*).—This article attempts to explain the fact that when sodium nitrate is applied to sugar beets very little of the nitrogen is washed out of the soil in normal seasons, but remains available in the humus of the surface soil. This is ascribed partly to assimilation by the beets and partly to the fixation of the nitrogen in organic forms as a result of biological processes, this organic nitrogen becoming available as it is required by the plants.

Chilean nitrate production and trade, R. E. MANSFIELD (*Mo. Consular Rpts. [U. S.], 1905, No. 297, pp. 129, 130*).—The statistics of this industry for 1904

are briefly summarized, showing that the production of nitrate in Chile in that year was 1,694,665 tons, which is 80,230 tons in excess of the production in 1903. The total exports were 1,630,488 tons, or 45,745 tons more than in 1903. The statistics show an increase in consumption of nitrate in the United States, but a slight decrease in Europe (France, Belgium, and Italy).

Calcium cyanamid and its use in agriculture, A. D'ERCOLE (*La calciocianamide ed il suo migliore impiego in agricoltura. Rome, 1906, pp. 120, pl. 1, figs. 15*).—This elaborate report, published by the Italian Society for the Manufacture of Agricultural Products, etc., after briefly referring to the principal nitrogen compounds used as fertilizers, discusses the utilization of atmospheric nitrogen, especially in the form of calcium cyanamid, reviewing experiments by various investigators with this substance, and reports in detail a large number of experiments with the substance on all classes of farm crops. The wide applicability of this material as a fertilizer is indicated by the results of these experiments.

Thomas-ammonium-phosphate, a new manure; its composition and results of manurial experiments in 1904, MÜLLER (*Illus. Landw. Ztg., 25 (1905), No. 32, pp. 303, 304; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 516, II, p. 650*).—This material is a mixture of Thomas slag or superphosphate and ammonium salts. In experiments with wheat, oats, rye, potatoes, and mangel-wurzels a mixture of slag and ammonium salts gave very satisfactory results. The fertilizer should be applied as a top dressing. There is little loss of nitrogen from the mixture if it is used soon after its preparation.

Ground rock for fertilizing purposes, A. S. CUSHMAN (*Science, n. ser., 22 (1905), No. 573, pp. 838, 839*).—Attention is called to a series of experiments with tobacco seedlings which it is claimed showed "that fine-ground orthoclase was very nearly, if not quite, as efficient as a source of potash plant food as the more soluble potash salts which are in ordinary use," and it is suggested that with improvements in methods and machines for grinding rock and transportation facilities "not only some of our feldspar deposits but even our richer potash-bearing feldspathic rock, like some of the granites," may be profitably employed as a source of potash.

Potassium salts, W. M. COURTIS (*Extr. from Mineral Resources of the United States, 1904. U. S. Geol. Survey, 1905, pp. 16*).—This paper gives statistics of the potash industry of Germany and discusses the possibility of finding potash and attempts to locate deposits in the United States.

Indications of possible potash deposits found in saline springs, oil wells, and bore holes, and in desert deposits are described, with determinations of potash in salts from various saline springs and desert deposits in California and Nevada. Seven localities in the United States which seem to offer favorable conditions for the discovery of potash deposits by boring are named as follows: Cody, Wyo.; Magnesian Lake, near Laramie, Wyo.; Byron Springs, Contra Costa Co., Cal.; Death Valley, Cal.; Sierra de las Cucapas basin, Lower California, extending into San Diego Co., Cal.; Boundbrook, N. J.; and Mount Tom, Mass. The report contains a bibliography of potassium salts.

AGRICULTURAL BOTANY.

Relation of transpiration to growth in wheat, B. E. LIVINGSTON (*Bot. Gaz., 40 (1905), No. 3, pp. 178–195, figs. 21*).—Investigations are reported on the relation between transpiration and the growth of wheat, cultures being grown in soil in wire baskets covered with paraffin, and water cultures grown in black bottles were used for comparison.

From the experiments the author concludes that total transpiration of wheat plants grown in various media is as good a criterion for comparing the relative growth in these media as is the weight of the plants. The amount of transpiration is practically a simple function of the leaf surface, and this varies with the leaf weight, which in turn varies with the weight of the entire tops. Thus it is believed that total transpiration is a measure for the growth of the plant.

It is held that the nature of the soil or solution in which the roots are grown has little or no influence on those structural and physiological properties of the leaves which control the amount of water lost per unit of leaf surface. In making use of this criterion of transpiration for the comparison of different nutrient media, the author says that it must be borne in mind that there will occur variations which appear to be unexplained. On this account the larger the number of plants used the nearer the results will approach the average.

It is shown also that temperature, atmospheric conditions, etc., influence total transpiration, and these factors must be considered in investigations of this kind.

The methods for comparison of plant growth provisionally established for wheat are said to hold good for grasses generally.

The development of root hairs, LAETITIA M. SNOW (*Bot. Gaz., 40 (1905), No. 1, pp. 12–48, pl. 1, figs. 6*).—The author reports investigations on the causes for the production of root hairs, preliminary experiments being made with a large number of plants and detailed investigations carried on with seedlings of wheat, corn, pea, and squash.

The effect of various factors in determining the development is shown, the author stating that light and darkness appear to have an indirect effect through their influence on growth. High temperature with sufficient moisture decreased the production of root hairs with an increased elongation of the internal cells. The slower the growth of the roots the better the development of the root hairs. Retardation of growth by glass tubes, wounding, or resistance favored root-hair production.

The roots of corn seedlings in water first assumed a curled condition, producing abundant root hairs, but later they grew straight and smooth, either on account of accommodation to the oxygen supply or because that gas was supplied through the aerial parts. A saturated atmosphere with high temperature tended to suppress the development of hairs, and a saturated soil showed a similar effect on corn and wheat seedlings. Curves and swellings on roots had a favorable effect upon the development of root hairs, probably on account of the retardation of the growth of the root.

The examples of retardation favoring root-hair development showed that it was not the rate of growth but the differential elongation of the inner and outer cells that was the important factor. Root-hair production seems to depend on the ratio between the capacity of the epidermal cells to elongate and their ability to do so, and the activity of the epidermis may be in inverse proportion to the activity of the central cylinder, lateral roots appearing when the root hairs are suppressed.

A bibliography of literature relating to this subject is appended.

Agricultural microbiology, E. KAYSER (*Microbiologie Agricole. Paris: J. B. Baillière & Sons, 1905, pp. XXI+440, figs. 100*).—In the introductory part of this book the author describes in a general way micro-organisms and the effects of physical and chemical agents upon their development, after which he takes up the rôle which they play in soil fertilization, describing their distribution through the soil, their action on manures, nitrification and denitrification, fixation of atmospheric nitrogen, etc.

In other parts of the work bacteria as applied to the transformation of vegetable and animal products are discussed under the headings of fermentation, vinegar manufacture, starch manufacture, baking, fruit and vegetable preservation, silage, flax retting, tobacco fermentation, and the bacteria of the dairy, tannery, etc.

On proteolytic enzyms, II, A. L. DEAN (*Bot. Gaz.*, *40* (*1905*), *No. 2*, *pp. 121–134*).—A study was made of the proteolytic enzyms of beans to determine the distribution of erepsin.

The results of the investigations show that the proteids of the seeds of beans undergo proteolysis during germination, as a preliminary to the transportation of the nitrogen and its utilization in the formation of new organs. The author says there are 3 ways in which this process may be carried out—by the action of a tryptic enzym, by the combined action of the protoplasm and of an enzym which by itself is incapable of carrying out the whole process, or by the action of the protoplasm alone.

The results of his studies of the resting and germinating beans show that there is no enzym present which is able to digest the proteids of the seed. There is present, however, an enzym of the ereptase group which is capable of digesting the proteoses resulting from the partial hydrolysis of the seed proteids. It is believed possible, therefore, that the protoplasm of the cells starts the process of proteid decomposition and carries it to some stage at which the ereptase takes up the work and completes the process.

On the structure and biology of the yeast plant, F. MUTCHLER (*Jour. Med. Research*, *14* (*1905*), *No. 1*, *pp. 13–50*, *pl. 1*).—The author describes investigations on the structure and biology of the yeast plant (*Saccharomyces cerevisiæ*), in which some important discoveries relative to the yeast plant were determined.

The author reports the presence of a relatively large nucleus, a definitely marked nuclear membrane, and characteristically differentiated granules and a reticulated network within the nucleus, which stains in every way as do the nucleoli of the cells, and the young cells are said to have the same organization as the more mature ones.

In studying the biology of the yeast plant the author experimented with pure cultures in various culture media, in which the effect of various agents upon growth was determined, and he concludes that from his investigations *S. cerevisiæ* is not a variable species, and any variation in form observed is due to the inherent nature of the cell rather than to external conditions. Variation in the size and rate of growth of cells may be produced by changes in the conditions under which they grow, and anesthetics do not permanently destroy growth or reproduction of this species.

Synthetic culture media and the biochemistry of bacterial pigments, M. X. SULLIVAN (*Jour. Med. Research*, *14* (*1905*), *No. 1*, *pp. 109–160*).—The author reports upon a series of investigations in which he undertook to grow bacteria in nutrient media of very simple composition and to also determine the conditions under which bacteria develop their pigments.

The experiments show that bacteria can in a great measure be grown on very simple media, and that from these simple combinations the micro-organisms can elaborate not only the protoplasm they require but also materials which pass through a porcelain filter and gives reaction for albumins. Not only can bacteria synthesize complex bodies from simpler compounds, but they are able to carry out their activity, producing pigment and in some cases forming ferments or enzyms. It was found possible to develop in an organism the power to grow on simple salts, either by accommodating the medium to the organism or adapting it to the medium.

Summarizing his investigations, the author concludes that the line previously drawn between chlorophyll-containing plants and those containing no chlorophyll, based upon their ability to build up protoplasm and albuminous products from simple solutions, can not be so sharply held as formerly.

The production of the different pigments is described, and the influence of different media on pigment production is shown. Pyocyanin is formed where there is present a suitable combination of carbon, hydrogen, oxygen, and nitrogen, together with some salt or salts to aid in the synthesis. For the formation of fluorescent pigments both sulphur and phosphorus are essential. The production of fluorescent pigments is favored by a high phosphate content and a slightly alkaline reaction. The red pigments of a number of species require the presence of magnesium sulphate and a phosphate, preferably potassium phosphate. The rose-red pigments investigated are produced only in the presence of lactic acid, while the yellow pigments of a number of species and a few red pigments are formed very slowly in nonalbuminous media.

The salts which favor the production of pigments are necessary, not to render the solution isosmotic, but for the direct nutrition of the bacteria or to fix the acids produced, which otherwise would have a toxic effect on the bacteria. The formation of pigment is dépendent upon the reaction of the media, suitable ranges of temperature, and the free access of oxygen. Abnormal temperatures, acid or alkaline media, and a lack of oxygen lead to a colorless growth. Besides the pigments and albumin-like bodies the chromogenic bacteria form acids and ammonia, which apparently arise from the breaking up of asparagin or sugar and are independent of pigment formation. The production of pigment, it is held, is not an essential, vital act.

The author concludes with an extensive chronological list of publications relating to the subject.

The mistletoes of caoutchouc, O. WARBURG (*Tropenpflanzer, 9 (1905), No. 11, pp. 633–647, figs. 5*).—Descriptions are given of species of Strutanthus, Phthirusa, and Phoradendron which attack caoutchouc and also occur on a number of other plants of economic importance in the Tropics.

New pocket atlas on edible and poisonous mushrooms, P. DUMÉE (*Nouvel atlas de poche des champignons comestibles et vénéneux. Paris: P. Klincksieck, 1905, pp. XV+145, pls. 64*).—Brief descriptions with colored illustrations of 66 species of mushrooms.

FIELD CROPS.

Report of the experimentalist, C. A. ZAVITZ (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 165–221, figs. 9*).—In a 4-year experiment with 12 varieties and classes of farm crops, common emmer stood first in average yield of grain with 2,621 lbs. per acre, Mandscheuri barley second with 2,616 lbs., and Joanette oats third with 2,497 lbs. It is estimated that barley has about 12 to 15 per cent of hull, emmer about 22 per cent, and oats approximately 30 per cent. The lowest yields of grain were secured from common grass peas and common spring vetch, the yields being 768 and 722 lbs. per acre, respectively. The adaptation of particular varieties of field crops to certain localities and soil conditions is pointed out.

The average results from 1 year's seed selection show that large seed surpassed small seed by 19.1 per cent for 5 grain crops, 40.3 per cent for rape, and 60.1 per cent for 5 kinds of field roots. The average results of several years show that plump seed of barley and wheat gave a yield of grain 20.2 per cent greater than shrunken seed. Experiments conducted for 6 years with sound and broken

seeds gave the following results: Barley 53.8 and 46 bu., winter wheat 46.9 and 9.3 bu., and peas 29.2 and 10.2 bu. per acre for the sound and broken seed, respectively.

Seed of Joanette black oats has been selected for 13 years in succession. In 1905 large plump seed produced 65.5, light seed 44.7, and hulled seed 69.4 bu. per acre, with the weights per measured bushel 35.5, 24.3, and 34.3 lbs., respectively. It required 1,149 grains of the crop from the large plump seed to weigh an ounce and 2,066 grains of the crop from the light seed for the same weight. Crops of oats, barley, and potatoes have been grown in the experimental department without change of seed for 16 years and for the 4 4-year periods the average results were as follows: Oats 74, 79, 83, and 100 bu.; barley 50, 54, 63, and 63 bu.; and potatoes 120, 216, 218, and 249 bu. per acre. These results show that the average yields for the last period surpassed the first period by 26 bu. per acre for oats, 13 for barley, and 129 for potatoes, and that therefore grain and potatoes can be grown for a number of years without change of seed with proper selection of seed and handling of crop.

Work in the improvement of the varieties of grain crops by plant selection showed that hand planting gave a much better opportunity for the plants to grow under uniform conditions than any other method. The crops were grown from seeds selected in 1903, and from seeds from selected plants in 1904, and planted 1 ft. apart each way. The average number of heads per plant the second year was as follows: Mandscheuri barley 13.5, Chevalier barley 31.7, Siberian oats 18.4, and Joanette oats 46.9. The results with improved strains of leading varieties of spring grain were compared, and in every case the yield of grain from seed obtained from selected plants was higher than that from seed from unselected plants.

In connection with this selection work it was ascertained that in 1905 the progeny of a single seed of different crops planted in 1903 amounted to 1,929 lbs. of Mandscheuri barley, 1,119 lbs. of Chevalier barley, 2,109 lbs. of hulless barley, 2,102 lbs. of Siberian oats, 3,439 lbs. of Joanette oats, and 241 lbs. of Wild Goose wheat. Of 250 varieties of oats under experiment, Joanette has produced the greatest yield of grain per acre, has been the greatest stooler, and has furnished grain exceedingly thin in the hull. It is, however, very short in the straw and it has, therefore, been crossed with Siberian, which has a straw of better quality and a white grain, but is not equal to the Joanette in the other characters. Some of the hybrids secured are long in the straw, possess good stooling qualities, and produce a white grain with a thin hull.

A test of different grain mixtures indicates that a mixture of oats and barley generally gives the highest grain production. Early Daubeney oats and Mandscheuri barley are recommended for this combination. Two varieties of winter wheat grown in a mixture gave practically the same results as the 2 varieties grown separately.

For 5 years oats, barley, spring wheat, and peas were sown on each of 6 dates in each year, the average first date being April 18 and the last May 23. For every day's delay in the seeding after the first week had passed in which the seeding was done there was an average decrease of 56 lbs. of oats, 53 of barley, 29 of spring wheat, and 23 of peas per acre. The results of a similar experiment with emmer and spelt show that spelt gave much the best yield from the first date of seeding, while emmer gave, on the average, better yields from late seeding. Emmer gave much better yields of grain than spelt.

Winter wheat sown during the first 10 days of September in each of 9 years yielded 5.2 bu. more than that sown from September 16 to 20. The average results of 6 tests in the time of cutting winter wheat were in favor of allowing

the crop to become very ripe. Sowing about 90 lbs. of winter wheat per acre on average soil is recommended. In 1905 the greatest yield of flaxseed per acre, less the seed used, was obtained from 2 pks. per acre. Oats and barley grown with red and alsike clover gave a slightly increased yield of grain, and when grown with timothy a slightly decreased yield per acre as compared with growing the crops by themselves.

During the past 17 years 279 different varieties of oats were tested, and of this number the greatest average yields per acre were produced by Joanette, Siberian, Waterloo, Oderbruck, Probstei, and Bavarian. From 1898 to 1903, 86 varieties of barley were compared. Four varieties of 6-rowed barley now under experiment for 16 years gave the following average yields per acre: Mandscheuri 69.8, Oderbruck 63, Common Six-rowed 61.1, and Mensury 58.7 bu. Of 2-rowed varieties grown for the past 5 years Two-rowed Canadian, Selected Canadian Thorpe, Jarman Selected Beardless, Duckbill, New Zealand Chevalier, and French Chevalier have ranked highest. In the average results for 5 years with hulless barley the following varieties ranked first with the yields given: Guy Mayle 51.8, Purple 48.5, Black Hulless 47.9, and Hungarian 46.8 bu. per acre. In 8 out of the past 13 years winter barley was successful, the average yield for the 8 years being 64.1 bu. per acre.

Fifteen varieties of winter wheat ranged in average yield for 5 years from 45.9 to 57.3 bu., and in the yield of straw from 3.2 to 4 tons per acre. The leading varieties mentioned in decreasing order of yield were Dawson Golden Chaff, Imperial Amber, Early Genesee Giant, Russian Amber, Early Red Clawson, and Egyptian Amber, all yielding over 50 bu. per acre. In general the white wheats yielded more grain per acre, produced a stronger straw, weighed a little less, and were slightly softer in the grain than the red varieties. The leading varieties of durum wheats grown for 5 years and their average yields were as follows: Wild Goose 40.2, Sorentina 36, Medeah 35.7, Bart Tremenia 33.8, Algiers 33.1, and Ontario 25.6 bu. per acre. In a 5-year average Wild Goose produced about 60 per cent more grain per acre than Polish wheat (*Triticum polonicum*).

The leading variety of spring rye, as determined by the average results for 8 years, was Dakota Mammoth, which gave an average of 37.9 bu. per acre. Mammoth White rye in the average of 6 years' tests produced 60.4 bu. per acre.

Various other field and forage crops were tested for different numbers of years, the leading varieties being as follows: *Buckwheat*—Silver Hull and Japanese; *field peas*—Early Britain; *field beans*—Pearce Improved Tree, White Wonder, Medium or Navy, Burlingame Medium, Schofield Pea, and Day Improved Leafless; *soy beans*—Early Yellow and Medium Green; *corn for grain*—King Philip, Genesee Valley, and Longfellow; *sorghum*—Early Japanese Broom Corn, Improved Evergreen Broom Corn, and California Golden Broom Corn; *millet*—Siberian, Hungarian Grass, German or Golden, California, and Early Harvest; *sunflowers*—Mammoth Russian White Beauty and Black Giant. In 1905 Manitoba and Common flax yielded 22.2 and 20.5 bu. of seed per acre, respectively, while Russian yielded only 16.2 and Holland 13.1 bu. per acre.

This season 104 varieties of potatoes were compared. The results for the past 3 years show that Robertson Champion, Stray Beauty, Early Pinkeye, Holborn Abundance, Skerries, Green Bay, and Seedling No. 230 had less than 5 per cent of rot in the average crop, while Montana Bluff had over 40 per cent and Beauty of Hebron, White Pinkeye, and Hanlan Beauty between 37 and 40 per cent. The best yields in 1905 were secured from Lightning Express and Davies Warrior, producing 427 and 420 bu. per acre, respectively. Factor, the lowest-yielding sort, produced 130 bu. The medium-ripening sorts were most

subject to rot and the latest-ripening varieties least so in 1904 as well as 1905.

In the average for 4 years the following varieties produced the greatest yields at 9 weeks after planting: Early Andes 174, Early Fortunate 170, Six Weeks 169, and Early Dominion 167 bu., and the lowest average yields at the end of the same length of time were produced by Burpee Extra Early, 113, and Stray Beauty, 124 bu. per acre. The results of 11 years of continuous seed potato selection show that in 1905 204 bu. was obtained from large whole potatoes, 183 bu. from medium-sized whole potatoes, 142 bu. from small whole potatoes, and 105 bu. per acre from very small whole potatoes. The percentage of small potatoes in the crops increased as the size of the seed decreased.

The use of 1 2-oz. potato set in the hill in the average for 6 years gave 211.9 bu., 2 1-oz. pieces 203.7 bu., and 4 ½-oz. sets in the hill 182.5 bu. per acre. The largest percentage of marketable tubers was secured from the 1 2-oz. set per hill planting. In 6 out of 7 years, planting potato sets 1 ft. apart in the row gave better yields than planting them in squares 33 in. apart each way. The average results for 7 years rather favor hilling than level cultivation. An application of 2 tons of poultry manure per acre gave better yields than the use of smaller or greater quantities, the yield of potatoes being increased by 56 bu. per acre.

In 1905 the following varieties of swedes ranked first in yield: Rennie Queen 22.8, Cropwell, 22.5, Good Luck and Sutton Queen 21.3, and Keepwell 21.1 tons per acre. Thinning the plants at one-half, 2, 5, and 8 in. in height resulted in the best yield from the thinning when the plants were very small. The yield of roots per acre from applications of cow manure and mixed fertilizer was about the same. The average yields with 4 varieties of fall turnips grown for 5 years were as follows: Red Top White Globe, 27.9, White Egg 23.1, Early American Purple Top 22.1, and Cow Horn 20.3 tons per acre.

Among 15 varieties of mangels grown for 5 years Yellow Leviathan stood first with an average yield of 33 tons of roots per acre, being followed by Steele-Briggs Giant Yellow Intermediate, Sutton Mammoth Long Red, and Mammoth Golden Giant. The average yield of tops per acre of the 15 varieties ranged from 2.1 to 6.4 tons per acre. In 3 out of 4 years seed soaked for 12 hours gave greater yields per acre than seed not soaked before sowing and that soaked for 24 and 36 hours.

Notes are also given on experiments with sugar beets and carrots. In experiments with varieties of silage corn it was observed that there was a variation from 15.2 to 24.1 tons of total crop per acre between the lowest and the highest-yielding strains of White Cap Yellow Dent, one of the best general purpose varieties for southern Ontario. Deep cultivation immediately after planting, followed by shallower cultivation as the season advanced, produced the largest yield per acre. In general, planting in hills 40 in. apart both ways with 4 plants in each hill, has given better results than planting 10 in. apart in the row. The results with several other forage crops, including sorghum, millet, rape, kale, cabbage, sunflowers, grass and grass mixtures, and a number of leguminous plants are reviewed.

Department of field experiments, P. O. VANATTER (*Virginia Sta. Rpt. 1905, pp. 30–33*).—The different lines of experimental work in progress are briefly described and some of the results obtained are given.

Fulcaster winter wheat proved one of the best-yielding varieties. Winter wheat, winter barley, and winter oats gave the best results when sown September 30 and winter rye when sown a month later. The yields of these winter crops were as follows: Fulcaster wheat 17 bu., Union barley 32 bu., Culbertson oats 56 bu., and Excelsior rye 26 bu. per acre. Of 25 varieties

of spring oats compared, Silver Mine and Texas Rust-proof led in yield with 39 and 35 bu., respectively, while the common oat generally grown in the State yielded only 11 bu.

The 6 leading varieties of corn tested were Boone County White, Virginia Golden Dent, Hickory King, Cocke Prolific, Blount Prolific, and Leaming. Boone County White ranked first in yield of grain per acre with 53.78 bu., being followed by Virginia Golden Dent with 52.84 bu. Leaming, which ranked last in yield, ranked first in earliness and was the only variety requiring a shorter period of growth than Boone County White. Blount Prolific gave the smallest percentage of barren stalks and Leaming the largest. A yield of 23 tons per acre was secured from St. Andrew ruta-baga.

Experiments at Ploty in 1904, P. Troubetzkoy (*Separate from Ghodichnuii Otchet Ploty, Selsk. Khoz. Opuitn. Stantzii, 10 (1905), pp. 31, dgm. 1*).—On account of an unfavorable season the yield of sanfoin did not exceed 2,580 kg. of hay, and the yield of beets varied from only 10,500 to 15,000 kg. per hectare.

Plowing 26.5 cm. deep decreased the yield of small grains by 14.3 per cent and of corn by 44.6 per cent as compared with plowing 8.8 cm. deep. The yields of sugar beets and potatoes, however, were better on deep than shallow plowing. Fall plowing for spring wheat gave an increase in yield of 450 kg. per hectare over spring plowing. It was found that even in a dry year barnyard manure was capable of increasing the yield of winter wheat by 41.4 per cent, sugar beets by 62 per cent, and spring wheat by 4 per cent. As the result of following perennial leguminous forage crops in the rotation the yield of winter wheat was apparently increased 33.3 per cent; that of sugar beets, 27 per cent; and of spring wheat, 6 per cent.

Reports from the director of agriculture on the government farms at Nairobi and Naivasha in the East Africa Protectorate for the year 1904, and on the prospects of settlers (*London: Parliament, 1905, pp. 49, pls. 12*).—Detailed descriptions are given of the equipment and work of the experimental zebra ranch and stock farm at Naivasha and the experiment farm at Nairobi. Brief notes on the field and garden crops grown at Nairobi are given, meteorological data recorded, and the prospects of settlers in the East Africa Protectorate are discussed.

Annual report of the Burdwan Experimental Farm for the year 1903–4, D. N. Mookerji (*Ann. Rpt. Burdwan Expt. Farm [India], 1903–4, pp. 10*).—General notes on the work of the farm, together with meteorological data and the results of experiments with various crops are presented.

In fertilizer experiments with paddy the best yields of grain and straw for 2 successive years were obtained where 240 lbs. of bone meal and 60 lbs. of nitrate of soda were applied per acre. The use of 8,000 lbs. of cow manure or 480 lbs. of bone meal gave nearly as good results. In a test with different fertilizers given in quantities supplying 50 lbs. of nitrogen per acre, the best yields were obtained where bone meal or bone meal and nitrate of soda were used. The best financial returns were secured from the use of nitrogen alone.

In an experiment testing the effect of green manuring for paddy the largest yields and the highest profits were secured where jute was plowed under. In cultivation tests with paddy spacing the clumps 12 in. apart in transplanting gave the best results. The comparative yields of 3 Bengal and 3 Bombay varieties of paddy are recorded.

In experiments with potatoes, castor cake used at the rate of 1,920 lbs. per acre gave apparently the largest yield, and in a green manuring experiment the largest yields were obtained where dhaincha was plowed under and cow manure and castor cake were applied singly. Whole tubers seemed to give

higher yields than cut sets, but the experiment did not show whether the lower yield in the case of cut sets was due to the cutting or to the smaller quantity of seed used.

The results of culture tests with sugar cane were in favor of the Poona system of irrigation beds about 10 ft. square and the Behar system of planting in double lines in trenches 3 ft. wide, separated by ridges of equal width.

Annual report of the Dumraon Experimental Farm for the year 1903-4, D. N. MOOKERJI (*Ann. Rpt. Dumraon Expt. Farm [India], 1903-4, pp. 9*).—A brief description of the farm, together with chemical analyses of the soil and meteorological data for the season are given. The best yields of grain and straw of paddy were secured where either 2,960 lbs. of cow manure or 1,456 lbs. of cow manure and 260 lbs. of castor cake were applied per acre. Among 6 varieties of paddy Sukhavel, a Bombay variety, and Badshabhog and Basmati, Bengal varieties, gave the best yields.

The highest yields of wheat for 2 successive years, as well as the best financial returns, were obtained on land fertilized with 6,984 lbs. of poudrette per acre. The Behar and Poona systems of planting sugar cane showed an advantage over the local system of planting. Planting whole sets of potatoes gave larger yields than the use of cut sets. The local variety of oats was more productive of grain and straw than Canadian Welcome.

Brief notes are also given on the culture of corn, mustard, rape, sweet potatoes, and forage crops.

Successful yields of small grains, G. W. CARVER (*Alabama Tuskegee Sta. Bul. 8, pp. 10, figs. 6*).—Cultural tests with wheat, rye, barley, and oats are reported, with estimates of cost of production and return. The results indicated that for the small grains in that section deep plowing, clean seed, and proper crop rotation are essential to their profitable culture, and that a crop of pea vines turned under is a very valuable fertilizer in this connection.

Lodged grain, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 91, 92*).—In connection with a study of preventing the lodging of oats the composition of the soil on which standing and lodged grain was found was determined, and is reported in a table. The plats on which the grain lodged contained the least lime and the most nitrogen.

Nutrients taken up by plants in different stages of growth, H. WILFARTH, H. RÖMER, and G. WIMMER (*Landw. Vers. Stat., 63 (1905), No. 1-2, pp. 1-70*).—Pot and field experiments were conducted for several years to study the quantities of fertilizing materials taken up by different crops in various stages of growth. The work is described and the analytical data secured are reported in tables.

Barley, spring wheat, peas, and mustard were found to have taken up the maximum quantity of fertilizing materials at the time of blossoming, or at the beginning of fruit formation. With the exception of phosphoric acid, part of this quantity of food elements returned to the soil as the crops approached maturity and this movement seemed to be dependent upon the supply of available plant food. As determined for potash, relatively larger amounts returned to the soil when the supply was inadequate than when it was sufficient.

Potatoes continued to take up plant food until ready to be harvested and a return movement to the soil did not take place. When the food supply was normal the quantity of dry matter increased until the plants were ripe. Starch also increased up to maturity in all plants except mustard, in which fat is substituted for the starch grains.

Alfalfa, G. A. BILLINGS (*New Jersey Stas. Bul. 190, pp. 1-19, pls. 4*).—The value of alfalfa as a forage crop is discussed and the methods of culture, includ-

ing directions for soil inoculation are outlined. It is reported that 16 acres of the college farm are devoted to this crop. As a remedy for blight, which attacks alfalfa fields in spots, cutting as soon as it appears is recommended. The personal experiences with the crop of a number of alfalfa growers in different sections of the State are also given.

The inoculation and cultivation of alfalfa, A. M. Soule and M. Ferguson (*Virginia Sta. Bul. 154, pp. 79–117, figs. 5*).—This bulletin discusses alfalfa culture in general and gives specific directions for growing the crop in Virginia. The culture and harvesting of alfalfa, its uses and feeding value, and purposes and methods of soil inoculation are treated quite fully.

It is reported that alfalfa seeded September 15 on heavy red clay lands had developed roots from 2 to 3 ft. long by December 1, and that 2 years after planting roots 4 to 5 ft. long were secured. Preliminary investigations begun in 1904 showed the importance of soil inoculation and the advantages of using lime and phosphates on land intended for alfalfa. With inoculation a more uniform and denser stand was secured than without it. Turkestan alfalfa did not seem adapted to the conditions. Plats inoculated with *Melilotus alba* and those treated with barnyard manure produced a good growth. Foreign soil and that obtained at the station for inoculation gave practically the same results.

The improvement of corn in Connecticut, E. M. East (*Connecticut State Sta. Bul. 152, pp. 21, dgms. 2*).—The principles of corn breeding are discussed and complete directions given for the selection of corn and the establishment and management of a breeding plat for seed-corn production. The plan for planting the breeding plat to avoid inbreeding is taken from Illinois Station Bulletin 100 (E. S. R., 17, p. 26).

Methods of testing variability in corn, E. Davenport (*Illinois Sta. Circ. 101, pp. 7*).—This circular outlines means for accurately testing the range and extent of variability in any particular variety of corn.

By the method proposed the differences between varieties of corn as to variation in the length of ear are determined by accurate measurements of several hundred ears of each variety, and definite values for all the differences are obtained by submitting them to well-known mathematical processes. The methods of making these computations are explained, and the tendency of a variety toward a certain length of ear together with its variation from this tendency, is pointed out. The mathematical formulas are given in detail.

Corn improvement, A. T. Wiancko (*Indiana Sta. Bul. 110, pp. 77–120, figs. 14*).—Much of the matter in this bulletin has been previously published and reviewed (E. S. R., 16, p. 1071). Some new data are reported and the directions for managing a seed corn breeding plat are revised and amplified.

A germination test by the station of lots of seed corn from different sources and unequal as to the number of ears showed that on the basis of 5 kernels from each ear the percentage of ears having a perfect germination ranged from 34.2 to 98.5. In 5 lots the number of ears failing to germinate varied from 3 to 25.2 per cent. In addition to these tests, 5 lots showed a germination of from 91 to 95 per cent; 4 lots, from 83 to 87 per cent; and 6 lots, from 60 to 75 per cent.

In studying the effect of grading the seed on the uniformity of dropping by the planter, it was found that per 100 drops when middle kernels only were used 3 kernels were dropped 92 times as compared with 66 times when the whole ear was used, and 75 times when deep and shallow kernels were mixed. With deep kernels alone 3 were dropped 92 times and with shallow kernels alone, 95 times.

An examination of the stand in a number of corn fields showed a variation of from 65.6 to 89.6 per cent of perfection. The percentage of ear-bearing stalks was found to vary from 49.2 to 84.8.

The average yields of different breeding plats at the station in 1905 varied from 63.2 to 104 bu. per acre as calculated to 100 per cent stand. The yielding power of individual ears on the different plats showed marked variations.

Corn selection, F. W. CARD and M. A. BLAKE (*Rhode Island Sta. Rpt. 1905, pp. 200, 201*).—This line of work at the station has been previously described (E. S. R., 16, p. 766).

The seed planted in 1904, taken from the upper-ear lot, with 8 ears per stalk, produced 222 1-ear stalks, 291 2-ear stalks, 101 3-ear stalks, and 8 4-ear stalks. Owing to immaturity and poor development the seed used in 1904 and 1905 did not germinate strongly and gave an uneven stand. The results showed a decided reduction in the number of ears per stalk over those produced in 1903, and they indicate that the well-known cultural conditions are of greater importance than the selection of seed from the most productive parent plants.

Chemical studies of hops in 1904, J. SATAVA (*Ber. Vers. Anst. Brauindus. Böhmen, 1905, No. 11, pp. 40, map 1*).—The discussion is devoted mainly to the volatile oils, the hop acids and resins, and the hop tannin.

The soft resins are divided into α-resin and β-resin, according to their behavior toward alcoholic lead acetate solutions. The α-resin, containing one of the hop acids called humulon, forms a precipitate in such solutions, while no combinations with lead are formed in the case of β-resin, which is associated with lupulin. The principal points brought out by this study, according to the author, are that the intensity of pure hop aroma increases with the α-resin and humulon, and that the quantity of these substances in the product from long-established hop districts is quite constant in different places and in different seasons.

The book of the potato, T. W. SANDERS (*London: W. H. & L. Collingridge, 1905, pp. IX+222, pl. 1, figs. 108*).—This book gives advice on the different phases of potato culture in the garden and in the field, and in this connection the history, botany, and marketing of the potato are discussed. Directions for combating the diseases of the plant and its insect enemies are given, and varieties for the production of early, medium, and late crops, aggregating 269 sorts, are listed.

Rice growing in Arkansas, W. G. VINCENHELLER (*Arkansas Sta. Bul. 89, pp. 117–128, figs. 4*).—An experiment in rice growing under the direction of the station was begun in Lonoke County in Arkansas in 1902, and continued in 1904 and 1905.

The results of the first year demonstrated that rice would succeed on the prairie lands under irrigation. Ten acres were grown in 1904, one of the plats yielding at the rate of 75 bu. per acre. In 1905 the area was increased to 30 acres, but owing to unfavorable weather conditions only 25 acres were harvested. About 17 acres of Honduras rice yielded 53 bu., and about 8 acres of Japan 67.53 bu. per acre, the average for the 2 varieties being 57.8 bu.

The dates of planting, flooding, and harvesting, together with the yields, are shown in a table, and general directions for growing the crop under Arkansas conditions are given. The history of rice culture in the United States is briefly noted.

Sugar beet industry, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 86–91*).—Statistics concerning the sugar-beet industry in Ontario are given, and a test of different varieties of sugar beets is reported. Of the large-growing varieties Giant White Feeding and Tankard Cream gave

the largest beets and the smallest amount of sugar. Improved Imperial, Rubensamen, and Mangel sugar beet proved equal in both sugar and purity to the Kleinwanzleben variety.

The results of experiments favor planting in rows 18 or 20 in. apart. The use of a small amount of nitrate of soda and fairly large amounts of sulphate of potash and superphosphate cause the beets to start quickly, and thus allowed thinning about 3 days sooner than where no fertilizer was applied. The fertilized plats gave a larger yield of beets and showed an increase of from one-half to 1 per cent in the sugar content.

Promoting the initial growth of the sugar beet, A. CSERHÁTI (*Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 36 (1905), No. 1, pp. 35–45; abs. in Centbl. Agr. Chem., 34 (1905), No. 8, pp. 530–532*).—The results secured by the author indicated that the growth of young sugar-beet plants is promoted by the use of the variety best adapted to the particular soil conditions, by the application in the drill of appropriate quantities of readily assimilable plant food in the form of commercial fertilizers, and by methods of soil preparation which enable the seed to be placed at uniform depths.

The von Kuffner method of seeding, as outlined, consists in rolling the land before planting, and attaching a small roller 12 cm. in width and weighing 40 kg. to the seed drill. This method assures a uniform soil condition as well as a uniform depth of planting.

Sugar and the sugar cane, N. DEERR (*Altrincham (Manchester), Eng.: Norman Rodger, 1905, pp. VIII+395+XIX, pls. 11, figs. 119, dgm. 1*).—This book is an elementary treatise presenting a general view of the cane-sugar industry. All the different phases of the production of the crop, as well as the details of cane-sugar manufacture and the management of the sugar factory, are discussed. Directions for the analysis of sugar-house products are also given. A bibliography containing 41 references is presented.

Progress report on the work of the Samalkot experimental sugar farm during 1903–1904, C. A. BARBER (*Dept. Land Rec. and Agr. Madras, Agr. Branch Bul., Vol. III, No. 51, pp. 21, pls. 5*).—The culture of sugar cane in the Gôdâvari delta is described and the results of experiments at the station discussed.

Among the different varieties of cane tested Red Mauritius gave the best results, the larger yield of cane being due not to a great tillering power but to the weight of individual canes. Vansi tillered most and had about 3 times the number of canes shown by Red Mauritius. This season the Red Mauritius produced a fine even stand when the whole plant was cut up for seed. Some varieties, as the Seema, can only be grown from tops, and an experiment with the Yerra cane gave almost twice as many shoots from cuttings taken from the upper ends as from the same number of cuttings taken from the lower ends of the cane.

Results of experiments with varieties of canes, J. B. HARRISON (*Georgetown, Demerara; Bd. Agr., 1905, pp. 9*).—Variety tests with sugar cane were made on a large number of plantations, and the results secured indicated that the varieties raised and selected locally were, in general, good ratooning canes and of greater merit than the imported Barbados varieties Sealy and B. 147. The estimates of the milling qualities of the different varieties were not concordant. Selections D. 625, D. 145, and D. 109 showed well-marked ratooning qualities and are recommended to cane farmers for trial. On one estate seedling varieties gave a yield of 7 per cent and on another of 30.7 per cent greater than Bourbon. D. 74, D. 78, and White Transparent showed signs of falling off in their yields and are no longer recommended for cultivation.

Varieties of tobacco seed distributed in 1905–6, with cultural directions, A. D. SHAMEL and W. W. COBEY (*U. S. Dept. Agr., Bur. Plant. Indus. Bul. 91, pp. 40, pls. 9*).—This bulletin treats of the tobacco seed distribution by this Department conducted for the purpose of testing the adaptability of the different varieties to conditions of soil and climate in various tobacco-growing sections. Descriptions are given of varieties of cigar wrapper, cigar filler, pipe, and plug tobaccos, and directions for the culture of these different classes of tobacco are presented. Directions for saving seed and securing good seed are also given.

Comparative values of different grades of wheat of crops of 1903 and 1904, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 76–82*).—In this study the percentage yield of flour; the weight per measured bushel; the percentage of moisture, acidity, proteids, and gluten, and the yield of bread per 100 lbs. of flour was determined in samples of wheat graded as No. 1 Hard and Nos. 1, 2, 3, and 4 Northern.

The percentage of protein in the flour from the various grades of the 1903 crop ranged from 9.98 to 11.13, while in the 1904 samples the extremes were 9.29 and 12.15. In the baking test a sample of No. 4 Northern produced the quickest working dough and also made the largest loaf, while a sample of No. 1 Hard made the smallest. This corresponded with the strength of the flour as indicated by the gliadin content. In the production of a white loaf No. 4 Northern, the lowest grade, was not equal to the higher grades.

In general the milling, chemical, and baking tests did not show any very wide differences in the products of the samples, but in yield of flour and in color of bread the lower grades were inferior while in strength and yield of bread no great variation was apparent.

The total proteids and the alcohol soluble proteids in samples of 6 varieties of spring and 20 varieties of winter wheat are reported. It is considered that although the data secured give a comparison of the probable strength of the various wheats, actual baking tests are required to show definitely the relative value of the different varieties.

Determination of the germinative power of grains, O. QVAM (*Landw. Vers. Stat., 62 (1905), No. 6, pp. 405–443, fig. 1, dgm. 1*).—The sources of error in the common method of determining the germination in grain samples, which consists in basing the results on the number of sprouted grains in a sample, are pointed out and a new method, considered more accurate, is described.

This new method, called the weight method, is based upon the weight of the dry matter in the young plants exclusive of the roots and is believed to be more accurate and reliable in showing the quality of the seed. Comparisons of the two methods were made and the variations in the results noted. The weight method gave, in general, quite uniform data. In seed of poor quality the variations were much greater in determinations by the common method than in those by the new method, but as the quality of the samples improved the differences between the two methods were reduced.

The grains, like all grasses, develop their permanent roots from the crown. The first roots thrown out by the seed are only temporary, and hence the development of the plant depends upon the permanent roots. The author points out that the stooling of grains botanically considered is the branching of the plant, and concludes from this and the foregoing facts that the stem controls the growth of the roots as well as the number of shoots, and that for this reason the value of the seed should be judged by the vigor of the portion of the plant above ground.

Different varieties of the same species were found to vary in the amount of plant substance produced on the surface of the ground. It was noticed that

in the case of oats the Duppau variety produced a greater weight than Ligowo, and this variety a greater weight than Tartar King. It is considered probable that these differences are due to the character of the hull and the kernel.

The personal factor in making the determinations is largely removed by the weight method, thus leading to uniformity in the results of different laboratories; and the sources of error are comparatively small, and no greater in samples of poor than in those of good quality. The method admits of the use of larger samples, and in this way tends toward greater accuracy. From a botanical point of view it has the preference over the germination method. It admits of simplification in determining purity, and the results refer not only to the number of germinable seeds in a sample but also to their viability, while the germination method simply shows the number of living seeds.

The results of field experiments seem to confirm the superiority of the method. Its application is described in detail.

Report of Danish seed control [station], 1903–4, K. DORPH-PETERSEN (*Copenhagen, 1904, pp. 56*).—A summary of the activities of the station during its 33d year is given and the results of examinations of farm and garden seeds for the year and for the preceding decade, with notes on the origin of the seed in the Danish market, the occurrence of noxious weeds, germination tests with seed of Danish wild plants, water content of seed, etc., are reported.

Experiments in progress since 1900 show that plantain and charlock seed retain their viability nearly without deterioration when buried in the ground. In another experiment 153 gm. of plantain and 186 gm. of camomile seed were fed to a cow, the number of seeds in the excrement determined, and their viability tested. About 86 per cent of the plantain seed and 33 per cent of the camomile seed were recovered. The viability of the plantain seed as shown on 2 different days was 62 and 53 per cent as compared with 89 per cent for the seed as fed, and of the camomile seed, 84 and 59 per cent as against 94 per cent for the original seed.—F. W. WOLL.

Rules and regulations governing the Colorado Patterson seed selection competition, W. H. OLIN and W. L. CARLYLE (*Colo. Agr. Col. Bul., 5. ser., 1905, No. 2, pp. 11, fig. 1, dgm. 1*).—The rules and regulations governing this competition are given, with explanations as to the way the awards are to be made and instructions for conducting the work.

HORTICULTURE.

Report of the horticultural division, F. W. CARD and M. A. BLAKE (*Rhode Island Sta. Rpt. 1905, pp. 197–219, pls. 4*).—This covers the results secured at the station in various cultural and breeding experiments with vegetables and fruits. Some notes on the apple maggot and on corn selection are noted elsewhere in this issue.

A severe wind storm occurring in September, 1904, gave an opportunity to estimate the relative resistance of some 28 varieties of apples to wind. The varieties York Imperial, Tuft Baldwin, Seek-no-further, Pomme Gris, Pewaukee, Mann, Northwestern Greening, and Palmer appeared to have the least resistance, while little or no fruit was blown from such varieties as Winesap, Roxbury Russet, Canada Red, Genet, and Ben Davis.

As a result of 6 years experimental work with bush fruits the conclusion is reached that the climatic conditions prevailing at the station are decidedly unfavorable to the growth of bramble fruits. It is thought that the great humidity caused by proximity to the ocean is one of the causes of injury to

this fruit. Experiments with these crops have therefore been practically abandoned.

A plan is given of a market-garden rotation experiment underway, the object of which is to determine whether it is possible to grow market-garden crops successfully without stable manure by means of a rotation in which cover crops can be used for maintaining the humus in the soil. The first year's rotation will consist of corn followed by beans on one plat and beans followed by corn on another plat. Some data secured on these plats in 1904 relative to the yield and appearance of the different crops are tabulated.

A common complaint from greenhouse men is that soil sterilization seems to destroy the life of the soil. A number of experiments were therefore undertaken to determine the growth of lettuce and radishes on (1) unsterilized soil, (2) soil sterilized and handled while hot, (3) soil sterilized but not handled till cold and dry, (4) soil sterilized, handled cold, and later sprinkled with garden soil, and (5) soil sterilized, handled cold, and nitrate of soda used.

The first year of the experiment the largest yield of both lettuce and radishes was obtained on the unsterilized soil, followed by the soil sterilized but not handled till cool and dry. The second year the largest yield of radishes was obtained on the sterilized soil to which nitrate of soda had been added, followed by the unsterilized soil, while with lettuce the largest yield was secured on the unsterilized soil and the smallest yield on the sterilized soil sprinkled with garden soil.

A number of vegetables were grown under tent covering to determine the effect of this partial shade. With transplanted lettuce grown under the tent the average weight per head was 6.57 oz., while the average weight per head of lettuce grown outside the tent was 6.19 oz. When seed was used, the weight of the heads grown inside the tent was 14 oz. and outside the tent 9.8 oz. It was found much easier to transplant lettuce under the tent than in the open. It grew faster under the tent up to the point of heading, but did not form as firm a head as those grown outside, nor was the quality quite as good.

Cauliflower grown under the tent made a better growth throughout the season than when grown outside. The plants were higher and the growth of the leaves much stronger, while the yield was 140 per cent greater inside the tent than outside. Under the tent the cauliflower was less attacked by insects and the heads were not so likely to discolor if not tied up just at the proper time.

With celery there was a smaller percentage of waste from that grown under the tent than from that grown in the open and the stalks were a little softer. Celery grown outside was a little shorter, more stocky, and slightly better in quality than that grown inside, and was more subject to rust.

Some data are given on the temperature inside and outside the tent, which shows that inside the tent it ranged from 1° to 12° cooler than outside, the average being 5.36° F. cooler.

A large number of strawberry seedlings have been grown, and the scale of points adopted in scoring plants and fruit with a key to the records of the plants is given. The purpose of the breeding work with strawberries is to secure late ripening sorts coupled with other good qualities. Crosses have been made on the wild plants for the purpose of introducing desirable flavors.

Report of the professor of horticulture, H. L. HUTT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 143-160, figs. 5*).—A general outline of the work of the year with orchard and small fruits, vegetables, and flowers, with data on the results obtained from the use of a large number of different

plants as orchard cover crops and on tests of varieties of currants and tomatoes.

Among currants the White Grape has proved the most productive variety of 46 grown. Of the red varieties Red Cross, Victoria, and Fay have proved most satisfactory. Naples has been the most productive of the black currants, but is not equal in size and quality to Champion and Black Victoria. The heaviest yielding tomatoes in 1905 were the Dominion Day and Earliana, the former of which produced 36 lbs. of fruit per plant and the latter 32 lbs.

Vegetable growing in Alaska, C. C. GEORGESON (*Alaska Stas. Bul. 2, pp. 46, pls. 4*).—An account of the climatic and soil conditions of various sections of Alaska with general observations relative to shelter belts, drainage, fertilizers, hotbeds and cold frames, seed testing, and detailed directions for the culture of vegetables based on the results of experimental work.

Heavy rainfall is stated as the chief drawback to successful farming and gardening in the coast regions. At Sitka the average rainfall is 90 in. The temperature rarely exceeds 80° F. in summer or falls below zero in winter. In the interior the summers are short but quite warm and the winters prolonged and severe. The rainfall is also light, and it is still a question whether irrigation may not be necessary in some of the drier regions.

The ground in the winter is frozen to an unknown depth. When cleared and exposed to the sun it gradually thaws. The ice is not a drawback to vegetable and grain growing after it recedes 2 or 3 ft., but rather an advantage, as it furnishes moisture to the growing plants and in dry seasons acts as a substitute for irrigation.

A peculiarity of Alaskan soil is that the vegetation turns into soil slowly and imperfectly and generally gives a very acid reaction. This is particularly true of the soils of the coast regions. It is greatly benefited by liming. Suggestions for burning native limestone are given. In the interior there is a great variety of soils, but they are generally of a sandy, gravelly, or light loamy character.

The following vegetables, for which detailed cultural directions are given, can be grown in Alaska:

"Group I.—Radish, mustard, turnips, kale, lettuce, orach. These can be grown throughout the whole coast region and in the interior northward of the Arctic Circle, nearly to the Arctic Ocean, in favorable seasons and in picked localities.

"Group II.—Carrots, parsnips, parsley, peas, cress, cabbage, cauliflower, broccoli, Brussels sprouts, kohl-rabi, onions, spinach, endive, leek, beets, potatoes, rhubarb, and among the herbs, caraway, catnip, marigold, mint, sage, thyme. These can be grown everywhere in the coast region in Alaska, and in the interior nearly to the Arctic Circle if the gardens are selected with due reference to shelter and exposure to the sun.

"Group III.—Asparagus, beans, celery, cucumber, squash, salsify. These can be grown in favorable seasons if planted in warm spots and given the proper care and protection.

"Vegetables which can not be grown in Alaska out-of-doors under ordinary garden culture, though they are common in the States, are: Sweet corn, melons, tomatoes, peppers, eggplant, okra, pumpkins."

Tomato culture, C. F. AUSTIN and E. W. HALSTEAD (*Estac. Cent. Agron. Cuba Bul. 4, pp. 16, pls. 8*).—Popular directions based on the results of experimental work at the station are given for the culture of tomatoes.

Many varieties were tested during the year and it was shown that first-class tomatoes can be grown in Cuba during all of the winter months. The tables included in the bulletin show the average yield per plant and per acre for the different varieties. Brief descriptive notes of 30 of the most promising varieties

are given. The following varieties mentioned in the decreasing order of productiveness are recommended: Matchless, Livingston Beauty, Acme, Earliana, Thorburn Earliest, Frogmore Selected, Rosalind, and Lemon Bush.

Tomato growing, R. THOMSON (*Jour. Jamaica Agr. Soc., 9 (1905), No. 12, pp. 443, 444*).—Tomato growing on a commercial scale for export to England and America is stated to be a success on the island. Tomatoes grown by the author on a quarter of an acre sold for nearly $200. Tomatoes shipped to London packed in fibrous material arrived there in good condition, and the fruit was considered equal to the best grown on the Canary Islands, from which place England secures large supplies.

Seed distribution of 1904 and for 1905, B. D. HALSTED (*New Jersey Stas. Bul. 191, pp. 19, pls. 4*).—In connection with the plant-breeding work of the stations a number of varieties of vegetables have been originated, and seeds of these have been distributed more or less freely throughout the State.

The present bulletin is made up largely of the reports of growers who have planted these various seeds. Very flattering results have been obtained with a number of these vegetables, more particularly the Voorhees Red sweet corn, Station bush Lima beans, Station yellow tomato, and the Station eggplants. The Malakhov sweet corn distributed by the station has proved a very satisfactory variety. Notes are given on further experiments in crossing Malakhov with Crosby and Premo sweet corns and in crossing Black Mexican and Country Gentleman.

With the latter varieties of sweet corn black appears to be a predominating color, and the crosses quite closely follow the law developed by Mendel in the case of peas. The Magnerosa tomato, secured by crossing Magnus and Ponderosa, is a nearly smooth and remarkably meaty tomato without the tendency to the green solid center sometimes seen in the Ponderosa. It is recommended for the main crop. A number of other crosses obtained with tomatoes are mentioned and described as well as some with squashes. A list of 20 varieties of seeds offered for distribution is appended.

Fruits for home orchards and gardens, T. V. MUNSON (*Texas Farm and Ranch 24 (1905), No. 51, p. 4*).—The author presents a table in which the adaptability of different varieties of orchard fruits, small fruits, and grapes to various classes of soils in Texas, New Mexico, Oklahoma, Indian Territory, Arkansas, and Louisiana is noted. The table shows in condensed form the results of the author's thirty years' experience in Texas as a fruit grower.

Fruit and fruit utilization, H. RÜHLE (*Ztschr. Angew. Chem., 18 (1905), Nos. 47, pp. 1852–1856; 48, pp. 1892–1900; 49, pp. 1941–1946*).—An extensive account of the fruit industry in Germany, including statistics on exports and imports, with details of analyses of a large number of orchard and small fruits, including some tropical fruits.

Details are given regarding chemical methods of fruit analysis, with a discussion and data on the changes which take place in fruits in after ripening. A discussion is also given of the normal amount of salicylic and boracic acids in many fruits. Extensive bibliographical references are included.

Pruning fruit trees, W. PADDOCK (*Colorado Sta. Bul. 106, pp. 15, pls. 2, figs. 13*).—Popular directions for pruning orchard fruits.

Blooming periods of tree fruits, H. L. PRICE (*Virginia Sta. Bul. 155, pp. 130–142*).—A general discussion is given of the causes of unfruitfulness, the value of mixed plantings, and the necessity of selecting trees for pollenizing each other which have the same period of bloom.

The bloom chart given is based on 13 years' observations at the station and shows the average blooming period during this time of the varieties of the various groups of plums, cherries, pears, crab apples, and apples. Among the

causes of unfruitfulness rapid wood growth of young trees, attack of bloom by fungi, long-continued rain during the blooming period, and self-sterility are mentioned.

Freezing of fruit trees, F. H. HALL and H. J. EUSTACE (*New York State Sta. Bul. 269, popular ed., pp. 8*).—A popular edition of Bulletin 269 of the Station (E. S. R., 17, p. 558).

Notes on varieties of apples, C. C. NEWMAN (*South Carolina Sta. Bul. 109, pp. 38, figs. 31*).—A large number of varieties of apples have been grown at the station for 12 years, the last 7 of which the trees have been in bearing. Many of these are varieties suited to supply fruit continuously from June to the first of April. Detailed descriptions and drawings are given of 30 of these varieties and recommendations as to the best summer, autumn, and winter varieties to plant in mountain regions, hill regions, and the pine belt.

Handling the apple crop, H. H. HUME (*Bul. N. C. Dept. Agr., 26 (1905), No. 9, pp. 22, figs. 9*).—Popular directions for harvesting and packing apples for shipment, with apple-shippers' rules regarding the standard barrels and requirements for different grades of apples.

Horticultural section, W. J. PALMER (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 278–294*).—Besides an account of the work of the year, a list is given of the aphis-resistant and blight-proof varieties of apples grown in New Zealand.

About new hardy oranges, H. E. VAN DEMAN (*Rural New Yorker, 65 (1906), No. 2921, pp. 40, fig. 1*).—The author discusses the work of J. L. Normand, Marksville, Louisiana, who is breeding new varieties of hardy oranges.

The hardy variety, *Citrus trifoliata*, is used as the male parent. Thus far one variety has been obtained which is considered of sufficient value to be placed on the market. This has been named "Carnegie," and is a cross with the Boone which is a very early orange. The Carnegie averages over 2 in. in diameter, and is of good flavor, though not as good as really choice oranges.

Timing of bananas (*Jour. Jamaica Agr. Soc., 9 (1905), No. 12, pp. 453–455*).—About a million bunches of bananas are now exported yearly from Jamaica. The best prices are secured for those marketed from the beginning of March until the end of June. Planters are therefore urged to so time their suckers as to produce fruit during this period instead of the more natural season of July to October.

Bananas and pineapples, Y. HENRY (*Bananes et Ananas. Paris: Augustin Challamel, 1905, pp. 141, figs. 19, maps 12*).—A treatise on the production and commerce of bananas and pineapples in French Guiana.

Preserving fresh berry fruits, T. ZSCHOKKE (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 617–619*).—Unripe gooseberries were washed in boiled water that had been allowed to cool, then put in cans and covered with boiled water which had become cool. The cans were then sealed and stored for eight months, at a temperature of about 16° C. At the end of this time the cans were opened. The water in which they were preserved had remained clear. There were no settlings in the bottom of the glasses, but the water had a very acid taste. The berries themselves were of full size, hard, and of a green-white color. They tasted almost like fresh unripe berries. The berries which originally had contained 27.2 per cent acid and 3.91 per cent sugar, contained at the end of the experiment 18.9 per cent acid and 2.72 per cent sugar, a loss of about 30 per cent of both constituents.

For such purposes as sauce where the water might be used along with the berries, there would be no loss, but for jelly-making purposes it was found that when only the berries were used the jelly would not set. Cranberries when

preserved in the same manner as the gooseberries kept in good condition for a year.

Does the acid content of berry fruits decrease when cooked with sugar? W. KELHOFER (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 601, 602*).—Cooking unripe gooseberries with sugar was not found to decrease the percentage of acid in the fruit. Earlier experiments by the author had shown a similar result with orchard fruits.

Changes in unripe gooseberries during after-ripening, W. KELHOFER (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 600, 601*).—Some data relative to the changes which take place in the after-ripening of gooseberries was obtained by the author.

Earlier investigations had shown that with black currants, picked when slightly green and kept for a few days, there was an increase in sugar and a decrease in acid content during the after-ripening. Gooseberries do not appear to act in the same manner. Picked June 24, when green, they contained 3.91 per cent of sugar and 27.2 per cent of acid. When kept at a temperature of 15.2° C. for six days, they had taken on a dark color and contained 3.42 per cent of sugar and 25.5 per cent of acid, a decrease in both cases during after-ripening.

Report of the viticulturist, R. BRAGATO (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 300–312*).—An outline of the work of the year is given. This, at the station, has consisted mainly in the propagation of American vines for resistant stocks.

Shallow culture of grapes, L. DEGRULLY and L. RAVAZ (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1905), Nos. 1, pp. 19–87; 2, pp. 148–188, figs. 34, dgms. 6*).—A review of the literature on this subject with the results of elaborate experiments to determine the effects of deep and shallow cultivation on root and vine growth of grapes.

Among the conclusions drawn are the following: Young vines from the time of setting out until the age of 3 years should receive ordinary good cultivation. The first roots are usually deep, and it is of prime importance that cultivation be such as to facilitate aeration of the soil to the depth of these roots. For older vines shallow culture is preferable on all compact, moist, or average soils. It is equally advantageous in sandy soils of the coast which are very dry at the surface but where the water table is high. On the other hand, in dry, gravelly, very permeable soils, where the water table is low and consequently the roots tend to establish themselves in the lower beds of soil, deep culture ought to give better results than systematic shallow culture. Diagrams are given showing the root development of vines on different soils cultivated to different depths.

The affinity of French scions with Rupestis du Lot in calcareous soils, E. ZACHAREWICZ (*Rev. Vit., 25 (1906), No. 629, pp. 17–20*).—The yields obtained during 5 years with five varieties of European grapes grafted on Rupestis du Lot are tabulated. Both the yield of fruit and the alcoholic content of the wine were above normal. The shoots on some of the vines in the experiment were pruned to a length of fifty to sixty centimeters. These vines yielded practically double the amount of wine obtained from vines pruned back to 2 buds.

Tests of varieties of grapes, W. KELHOFER (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 598–600*).—In tests of 28 white and 14 red varieties of grapes in 1903, for wine making, the average sugar content of both kinds was practically the same, but the acid content averaged about 3 per cent higher in the red than in the white varieties.

Relation of sugar to the weight of the must and to the acid in grape juice at the Wädenswil Experimental Vineyard during the past 14 years, W.

KELHOFER (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 596–598, dgm. 1*).—A table is given showing the composition of the must as regards sugar and acid content for each crop of grapes grown at the station since 1891. The data show that as the percentage of sugar increased in favorable years, the acid content decreased in similar manner.

The Persian walnut, J. G. RUSH (*Ann. Rpt. Penn. Dept. Agr., 10 (1904), pp. 537–539*).—Most of the Persian walnuts grown in the East, the author states, are seedlings. It is only occasionally that one of these seedlings is productive. It is believed that if seedlings are grafted from these productive sorts, the growing of Persian walnuts would become a profitable industry in many eastern States. In the author's investigation only 4 per cent of the Persian walnut trees observed were worthy of propagation.

Queensland nut, W. J. ALLEN (*Agr. Gaz. N. S. Wales, 16 (1905), No. 10, pp. 1026–1028, figs. 3*).—Brief descriptive account of this nut, *Macadamia ternifolia*, also known as Australian hazelnut. The illustrations show the general outline of the tree and the character of the fruit at different stages of growth.

Coleus with edible tubers, A. CHEVALIER and E. PERROT (*Vég. Utiles Afrique Trop. Franç., 1 (1905), No. 1, pp. 100–152, pls. 8, figs. 15*).—Descriptions are given of the edible species of coleus encountered in tropical Africa with illustrations of the plants and tubers and of cross sections of the tubers and of the starches contained in the different species.

It appears that in the west and central portions of French Africa four species of coleus are cultivated for their tubers. The most prominent of these is *Coleus rotundifolius* or Madagascar potato. This species it appears is also cultivated under different names in Java, Ceylon, and the East Indies. There are a number of varieties of this species. *C. dazo* is also cultivated on a large scale in Central Africa producing a tuber which differs considerably from the Madagascar potato and which it is believed is destined to take a prominent part in the future of tropical agriculture.

A third species *C. langouassiensis*, cultivated locally in the vicinity, appears to be the heaviest yielding of the three varieties noted. It is believed that all of these three species will prove of great importance to Europeans living in tropical countries. A minor species is *C. brazzavillensis*. Historical and botanical descriptions are given of a number of other species of coleus. Analyses with reference to food value are given for three of the most important species with cultural suggestions. Yields of 30 to 40 tons of tubers per hectare are reported.

Carnation breeding, H. F. HALL (*Amer. Florist, 26 (1906), No. 921, pp. 6, 7*).—The season from October 15 to December 1 is considered the most favorable for carnation breeding. Some varieties of carnations from which it is difficult to obtain pollen have been induced to produce pollen by growing them in pots in winter and keeping them rather dry.

In transferring the pollen to pistils the best results have been obtained by using a strip of ordinary blotting paper 3 or more inches long and about one-half inch in width, one end being cut with scissors to resemble a sharpened pencil. The point, however, is slightly fluffed to enable it to take up and hold the grains of pollen until lightly rubbed over the stigmatic surface of the pistil.

The objects and plan of the Heeleaka Experimental Station, H. H. MANN and C. M. HUTCHINSON (*Indian Tea Assoc. [Pamphlet] 2, 1905, pp. 11, pls. 2*).—An outline of the fertilizer, green manuring, pruning, and plucking experiments which are being carried on under the direction of the authors at this tea station. The station has been located at Heeleaka, near Moriari, Assam.

Society for Horticultural Science (*Amer. Florist, 26 (1906), No. 924, pp. 147–149*).—Somewhat extended abstracts are given of the papers presented at the annual meeting of the society held in New Orleans, December 29, an account of which has been given (E. S. R., 17, p. 616).

FORESTRY.

The forester, J. NISBET (*Edinburgh and London: William Blackwood & Sons, 1905, vols. 1, pp. XX+506; 2, pp. XV+642, figs. 285*).—These two volumes are based on the sixth edition of *The Forester*, issued in 1894, and are intended to serve as a text-book of British forestry and arboriculture. The 3 chapters, into which part 1 is divided, treat in a general way of the history of forestry in Great Britain, the present condition of the woodlands, technical forestry education, and the economic importance of forestry. Part 2, consisting of 2 chapters, is devoted to British sylva; and part 3, made up of 7 chapters, to sylviculture.

Wood, J. BEAUVERIE (*Le Bois. Paris: Gauthier-Villars, 1905, vols. 1, pp. XII+1–704; 2, pp. 705–1402, pls. 16, figs. 485*).—This work treats of the structure and qualities of timber, the composition and chemical properties and the general character and physical properties of wood, forests, lumbering, timber trade, defects in timber due to faulty methods of growth and to fungus, insect and other animal enemies, preservation of wood, wood essences, such as resin, native or naturalized woods, cork, wood production of the world, woods of the French colonies, and the utilization of wood.

The lumber industry (*Tradesman, 54 (1906), No. 9, p. 94*).—Statistics are given showing the States in which timber land is owned by lumbermen, capital invested, and number of acres. The average quantity of merchantable timber per acre and the estimated quantity of merchantable timber in feet are also given.

Evergreens; how to grow them, C. S. HARRISON (*St. Paul, Minn.: Webb Pub. Co., 1906, pp. VI+95, figs. 19*).—Popular directions for growing evergreens in the prairie States.

Artificial fertilizers in forestry, HENZE (*Deut. Landw. Presse, 32 (1905), No. 94, pp. 783–785, figs. 9*).—Data with illustrations are given showing the much more rapid growth of seedling forest trees with than without fertilizers.

Plan for the manuring of forests, SCHWAPPACH (*Ztschr. Forst u. Jagdw., 38 (1906), No. 1, pp. 49–52*).—An extensive plan is given by which different green manures and fertilizers may be tested comparatively for forests.

The water content of diluvial forest soils, E. RAMANN (*Ztschr. Forst u. Jagdw., 38 (1906), No. 1, pp. 13–38*).—An account of extensive experiments on forests and cut-over areas to determine the water content of such soils and the effect on water content of different methods of cultivation. The experiments were carried out in 1894–5, and the details are given at length in tabular form. Among the most important conclusions are the following:

Under otherwise like conditions the water content in soils heavily timbered is less than in the soils of cut-over areas. Water content is only one of the important factors in tree development. Soils with like water content may be very different and soils with a very different water content may belong to the same yield class. Cultivation of sandy soils increases the water content considerably. The influence of cultivation is felt only over the cultivated areas. Neighboring areas show no noticeable change. The surface layer prominently influences the water content of sandy soils. This is particularly true of the humus layer on

mineral soils, which during the period of tree growth greatly lessens the water content of the soil.

A study of the form and development of the roots of the pine and other trees, A. Tolski (*Trudui Opuitn. Lyesn., 1905, No. 3, pp. 1–62, pls. 6, figs. 18*).—A study of the root system of trees under varying soil and topographic conditions was undertaken by the author with a view to ascertaining the causes of the decay of pine plantings in the Buzuluk Forest, in the government of Samara. The investigations were begun in 1903 and have been carried on with pines 3 to 100 years old, and with birches, aspen trees, and linden.

Among the conclusions are the following: One of the main factors which exercises a more or less considerable influence on the structure of the roots is the depth to moisture. With humidity in close proximity, then, simultaneously with the development of the superficial roots, the development of the vertical ones takes place. If, on the contrary, the humidity is at a considerable depth then the development of the superficial roots greatly predominates. The length of all the roots is in general much greater in the leafy trees than in the pine, the linden being an exception. With pines it was observed that the root system on poor soils was much more developed than on fertile soils. The investigation will be continued.—P. FIREMAN.

Root pruning forest trees (*Österr. Forst u. Jagd Ztg., 23 (1905), No. 46, p. 386, figs. 5*).—Stub root pruning has been practiced by the author with a number of different species of seedling forest trees during the last 2 years with very good results. Illustrations are given showing the character of the root system developed when thus pruned according to the Stringfellow method, and it is thought this method of treatment may have application in forestry practice.

Root pruned trees (*Rural New Yorker, 64 (1905), No. 2918, p. 931, fig. 1*).—As the result of extensive experiments in planting stub pruned peach trees, the author is convinced that the long roots usually left on trees at transplanting are useless.

He does not prune back to the extent recommended by Stringfellow and use a crowbar in setting out the trees, because of the difficulty of packing the soil firmly under the roots of the trees in such holes. He thinks it better to leave short stubs at the sides of the roots, pruning them from the under side. A hole is then dug just large enough to hold the roots without cramping and the earth pounded and packed solidly around them. An illustration is given showing the very satisfactory development of roots on trees thus pruned.

Note on increment of spruce in West Virginia and fire losses, B. E. Fernow (*Forestry Quart., 3 (1905), No. 4, pp. 346–348*).—On a property of 75,000 acres 3,000 acres are cut each year. A portion of the area was burned over in the seventies and the new growth is about 25 years old.

From measurements of this growth the author shows that during the 25 years that would be necessary to cut over the whole area about 8 cords of wood per acre would be produced on the first area cut. If fire could be kept out of the forest entirely it is estimated that after the whole tract had been lumbered over an annual harvest of 28,000 cords of wood, worth then probably more than $100,000, could be secured for at least 25 years if not continuously. On this basis it is believed that it would be financially profitable to provide for immediate fire protection.

Notes on the rate of growth of red cedar, red oak, and chestnut, H. S. Graves (*Forestry Quart., 3 (1905), No. 4, pp. 349–353*).—Tabulated data are given showing the diameter and height of these trees at different ages.

A study of 23 red cedar trees at New Haven, Conn., showed that a tree growing in the open required 30 years to yield a post 6 ft. long and 4 in. in diameter at the top end; that a tree 40 years old might yield 2 such posts;

and that from a tree 50 years old, 1 post 10 ft. long and 1 post 6 ft. long could be obtained. The data for red oak showed an average diameter of 3.5 in. and a height of 36 ft. at 20 years of age and a diameter of 10.4 in. and a height of 70 ft. at 60 years of age.

In the case of chestnut sprouts it was found that a pole 30 ft. long and 6 in. in diameter could be grown in the open in 30 years and in the forest in 40 years. It is thought probable that in 50 years 100 to 150 trees per acre at least 13.7 in. in diameter at breast height could be produced. If 125 trees straight enough for poles could be secured in 50 years a stumpage value in poles alone of $125 would be attained. The tables given show the rate of growth of chestnut sprouts in New Haven, Conn., and at Milford, Pike Co., Pa.

On the rate of growth of birch in the mountain regions of Jämtland, Sweden, G. ANDERSSON (*Skogsvårdsför, Tidskr., 3 (1905), No. 11, pp. 417–422*).—Determinations in 3 different districts at altitudes ranging from 600 to 700 m. showed that the average increase in diameter per year for birch was 1.45, 2.45, and 3.05 mm. Fuel wood of 15 to 20 cm. diameter will accordingly require the following periods for full growth: 50 to 65, 60 to 80, and 100 to 140 years for the different districts, respectively.—F. W. WOLL.

Instructions for making forest maps and surveys, G. PINCHOT (*U. S. Dept. Agr., Forest Serv. [Circ.], Oct. 5, 1905, pp. 10*).—Directions for the use of various surveying and map-making instruments and of different colored pencils and signs which are to be used in the Forestry Service to secure uniformity in map work.

Report of the lecturer in forestry, E. J. ZAVITZ (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 222–227, figs. 6*).—A general outline of the work of the year, with a list of the various species of trees growing in the college plantation and nursery.

Forest belts of western Kansas and Nebraska, R. S. KELLOGG (*U. S. Dept. Agr., Forest Serv. Bul. 66, pp. 44, pls. 6, map 1*).—A study was made of the forests of western Kansas and Nebraska and eastern Colorado, included between the ninety-ninth and one hundred and fourth meridian, and the northern boundary of Nebraska and southern boundary of Kansas and Colorado. This area includes about 109,000 square miles. The physical conditions of the country are first noted, followed by a discussion of the natural forest types of the region.

In Kansas and Nebraska the natural forest growth is limited to the river courses and a few upland areas of pine and cedar. The pine type is chiefly prominent in northwestern Nebraska, while the valley type is the common forest type of the river courses in Kansas and Nebraska. While the pine type is of the greater economical importance, the valley or broadleaf type is of interest to a much larger number of people. Most of the pine forests of value have been cut away and destroyed.

A study was made of the reproduction of rock pine. In one instance, out of a total of 1,509 seed gathered from fallen cones, only 20 were good, and out of 2,253 seed from green cones only 1 in 7 was good. The chief cause of the defectiveness in these cases appeared to be in the failure of the seed to develop.

Tables are given showing the rate of growth of young rock pine in different counties of Nebraska. Red cedar has been quite completely cut out, but where such trees exist the reproduction is generally good and much larger than that of pine. The principal enemies to tree production are stock, fires, and to some extent the tip borer of pine.

The prevailing species of timber along the river courses are white elm, hackberry, red mulberry, green ash, box elder, cottonwood, and almond-leaf willow. The number of these trees on various sample areas in different counties of

Kansas are given, together with data as to their minimum and maximum diameters breast-high. The rate of growth of white elm, green ash, hackberry, and bur oaks in different localities is also shown in tabular form. On 31 sample areas examined in western Kansas the reproduction of the valley type was good in but 6 instances. In 6 more it was fair, while in the remaining 19 it was very poor, due in a large measure to unrestricted grazing.

A general discussion is given of how forest extension is brought about, with brief descriptive accounts of 28 species of trees found in western Kansas and Nebraska.

Forest reserves in Idaho, G. PINCHOT (*U. S. Dept. Agr., Forest Serv. Bul. 67, pp. 90, figs. 5, map 1*).—This bulletin contains copies of the correspondence and papers relating to the creation of forest reserves in Idaho.

Forestry in Maryland, W. D. STERRETT (*Forestry and Irrig., 11 (1905), No. 12, pp. 571–580, figs. 9*).—A discussion of the general forest conditions in the Appalachian, Piedmont Plateau, and Coastal Plain regions of Maryland, and of the progress of forestry in these same regions. About two and one-half million acres, or 40 per cent, of the total land area of the State is woodland, but less than 1 per cent of the wooded area is virgin forest. Most of the second-growth forests are under 150 years of age. The chief lumber tree is yellow pine.

Report of the superintendent of forests, W. F. FOX (*N. Y. State Forest, Fish and Game Com. Ann. Rpt., 10 (1904), pp. 9–34, pls. 12*).—A general review of the work of the year 1904, relative to control of forest fires, reforesting, lumbering operations throughout the State, seed gathering, exhibit made at the St. Louis Exposition, etc.

In the Adirondack forests 578,592,440 ft. B. M. of lumber were cut, and 31,516,450 shingles, and 52,659,692 laths made. In the Catskill forests 120,695,320 ft. B. M. were cut. Five hundred bu. of white-pine cones were secured during the year, from which 500 lbs. of clean seed were obtained, at an average cost of 47.5 cts. per pound.

Belgian woodlands and their management, F. H. OSMOND-SMITH (*Agr. Students' Gaz., n. ser., 12 (1905), No. 5, pp. 155–163*).—An account of the visit of the Royal English Arboricultural Society to a large number of Belgian state and private forests with notes on the forestry practices observed in different localities of Belgium.

The forestry conditions and management of Bosnia and Herzegovina, L. DIMITZ (*Vienna: Wilhelm Frick, 1905, pp. VIII+389, map 1*).—An account of the history, cultural condition, climate, vegetation, people, and development of the forests under Austrian supervision during the past 25 years of these provinces where about 5,000,000 acres are devoted to forestry.

An account of the methods pursued in the systematic management of these forests and of the results obtained is of especial interest to American foresters, since forestry conditions at the time the work was begun are more or less comparable with forestry in certain parts of the United States at the present time. A list of the numerous publications consulted by the author in the preparation of this work is appended.

Report of the conservator of forests, Natal, T. R. SIM (*Rpt. Conserv. Forests Natal, 1903–4, pp. 67, maps 2*).—An account of the forestry service of Natal and of the work done in the demarcation of forests, afforestation, establishment of nurseries, forest protection, revenues derived from state forests, condition of the game preserves, and the preparation of land for a fruit orchard.

An outline is given of an experiment underway in the use of fertilizers for black wattles, and of different quantities of seed sown broadcast in clumps and at different distances apart. An experiment was also made to see if chemicals could be drawn into wattle timber by natural suction which would render it

durable and ant proof. A copper sulphate solution was used and 4 wattle trees varying from 4 to 6.5 in. in diameter and 40 to 56 ft. high were cut off and the cut ends placed in tubs of the solution, the trees being supported in a vertical position. With 2 of the trees the bark was peeled off.

With both peeled and unpeeled trees the solution was rapidly taken up, sinking in to a depth of 0.5 to 1 in. in the stem. The experiment is believed to be too expensive to be of practical use. Nevertheless, poles from these trees have been planted and the length of time they remain sound will be noted.

The wattle industry in 1903 amounted to 12,135 tons. Neither *Acacia mollissima* nor *A. dealbata* was found a satisfactory source for paper pulp.

Forestry in Kiao-chou, Borgmann (*Ztschr. Forst u. Jagdw., 37* (*1905*), *No. 12, pp. 790–802*).—General notes on the political and forestry conditions in this German colony in China, with an account of the results obtained in planting many species of broadleaf and evergreen trees. The only species of pine that has succeeded is *Pinus thunbergii*. The gingko tree (*Gingko biloba*) also grows well. On the whole considerable progress has been made along forestry lines under rather unpromising conditions.

The effects of the great frosts on the forests of northern India, E. R. Stevens and E. A. Courthope (*Indian Forester, 31* (*1905*), *No. 8, pp. 435–440*).—Notes on the effects of the abnormal frost, during January and February of 1905, on the Dun and Saharanpur forests, with lists of the trees and shrubs most injured and of those apparently unaffected by the frosts.

Para rubber in Ceylon (*West Indian Bul., 6* (*1905*), *No. 3, pp. 302–306*).—The results are given of observations on the growth of Para rubber in the Royal Botanic Gardens of Ceylon with an account of the chemistry of Para rubber, analyses being given of the fresh leaves and stalks, decayed fallen leaves and stalks, and of the wood and branches. The data are quoted from a circular of the Royal Botanic Gardens, Ceylon.

Results of the experimental tappings of Hevea brasiliensis, W. R. Tromp de Hass (*Agr. Bul. Straits and Fed. Malay States, 4* (*1905*), *No. 8, pp. 285–292; Teysmannia, 16* (*1905*), *No. 3, pp. 182–190*).—This article gives the results of experiments carried on at the Economic Gardens at Tjikeumeuh during 1900–1904.

In one experiment when the lengths of the incisions per square meter of surface were 104, 320, and 740 cm., respectively, the corresponding yields were 158, 384, and 407 gm. of rubber. It is thus seen that in the latter instance when the length of the incision was more than doubled the increase was but 23 gm. of rubber per square meter of tapped surface.

In another experiment the wounds were opened on both the upper and lower edges and the resulting rubber yield compared with that obtained when only the lower edge was cut. Where both edges were opened the average yield in one test was 238 gm. per square meter of surface as compared with 143 gm. when only the lower edge was opened.

Notwithstanding the fact, however, that more rubber can be obtained by reopening both the upper and lower edges this increased yield does not cancel the disadvantages of the incisions becoming so broad as to interfere with proper healing. It is therefore suggested that if after the wounds have been reopened 10 times they still yield much latex, it is advisable to continue the tapping a little longer only on the lower edge of the incisions instead of working both edges.

As to the time of year when the trees should be tapped, the author states that in wet years it does not matter when the Hevea trees are tapped. In normal years the best times for tapping are generally at the beginning and end of the wet seasons.

DISEASES OF PLANTS.

Recent researches on the parasitism of fungi, H. MARSHALL WARD (*Ann. Bot., 19 (1905), No. 73, pp. 1–54; abs. in Bot. Centbl., 98 (1905), No. 16, p. 419*).—This is an address delivered by the author before the British Association for the Advancement of Science, in which he reviews the literature relating to parasitism of fungi, paying particular attention to the parasitism of cereal rusts.

The author in concluding his paper rejects the mycoplasm hypothesis of Eriksson, and states that inasmuch as uredospores can be found almost continuously the year round, and that they may develop on tufts of grass here and there during the winter and retain their germinating power for at least 2 or 3 months and perhaps longer, and, further, that specialized forms can occasionally infest races of wheat which normally prove immune, there is no necessity for explaining parasitism by any mycoplasm theory.

He has been unable to find any trace of mycoplasm, and from the present facts regards the revision of the hypothesis as necessary. He predicts that if infesting spores are sought for by means of serial sections they will ultimately be found.

A bibliography of more than 200 papers relating to parasitism of fungi is appended to the address.

Some recent observations on plant diseases, P. RIPPERT (*Fühling's Landw. Ztg., 54 (1905), Nos. 14, pp. 481–487; 15, pp. 513–516*).—A summary is given of the present status of knowledge regarding a number of diseases of economic plants, and means are suggested for their control.

Among the diseases described are the blackleg of potatoes due to *Bacillus phytophthorus*, rusts of cereals and grasses caused by different species of Puccinia, cereal smuts, blights of cereals due to *Helminthosporium gramineum* and *H. teres*, and the gummosis and canker of fruit trees. For the prevention of cereal smuts the author recommends the formalin treatment of the seed.

On endophytic adaptation shown by Erysiphe graminis under cultural conditions, E. S. SALMON (*Ann. Bot., 19 (1905), No. 75, pp. 444–446*).—In other papers (see below) the author has pointed out the fact that certain species of Erysiphe under cultural conditions are able to infest their host plants when their conidia or ascospores are placed on the cells of the internal tissues exposed by wounds, etc.

In the present paper an abstract is presented of a longer report, giving the results of experiments carried on with the conidial stage of *E. graminis*, a strict ectoparasite under normal conditions. The author shows that this mildew is not so highly specialized as an ectoparasite as to be restricted for its food supply to the cells of the epidermis, but is capable of adaptation to conditions closely resembling those obtaining in endophytism.

This suggests the possibility that under some circumstances the mycelium of species of Erysiphaceæ may penetrate into the internal tissues of their host plants exposed through wounds caused by the attacks of animals or by physical agency. It is pointed out, however, that the entry of the hyphæ might probably be prevented to a considerable extent by the drying up of the superficial layers of cells or by the healing processes which take place with great rapidity in the leaves.

Further cultural experiments with "biologic forms" of the Erysiphaceæ, E. S. SALMON (*Ann. Bot., 19 (1905), No. 73, pp. 125–148; abs. in Bot. Centbl., 98 (1905), No. 16, pp. 418, 419*).—In the present paper experiments are described

in which inoculations were made of various species and races of grass with *Erysiphe graminis*.

The leaves were injured and thereby rendered susceptible to the attacks of conidia and ascospores. The injuries were inflicted by bruising the leaves, pressing them under weights, the action of narcotics, heat, etc., and it is pointed out that injuries similar to those artificially produced in the experiments are constantly inflicted on plants in nature by animals, frost, wind, hail, etc. In the experiments with barley leaves they were rendered susceptible by the agricultural practice of rolling the crop.

As an explanation of the susceptibility of injured leaves, the author assumes that in consequence of the vitality of the leaf cells being affected the protection normally afforded by enzyms or similar substances ceases.

The results obtained in these experiments show that "susceptibility can be induced not only by various kinds of mechanical injury, but also by such interference with the normal functions of the cell as follows the application of anesthetics and heat. The conidia of the first generation produced on leaves of a strange host plant previously subjected to the action of alcohol, ether, or heat retain the power of infecting their original host, and do not acquire the power of infecting normal leaves of their temporary host."

The vegetative life of some Uredineæ, J. ERIKSSON (*Ann. Bot., 19 (1905), No. 73, pp. 55–59; abs. in Bot. Centbl., 98 (1905), No. 16, p. 415*).—The author presents in a paper read before the British Association some additional evidence to substantiate his mycoplasm theory regarding rust infection.

Report of the botanist and geologist, W. LOCHHEAD (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 43–58, figs. 2*).—A review is given of the progress in this department during the author's occupancy as professor of botany and geology, after which an account is given of some spraying experiments with grapes for the protection of the vines against grape rot and experiments for the destruction of the San José scale.

The season was unsatisfactory for spraying experiments, as there was but little disease present in any of the vineyards, and the experiments will be repeated. In the spraying experiments for the protection against the San José scale a number of mixtures were tested, but none of them proved as effective as the lime-sulphur washes in common use. A brief account is given of potato spraying in which Bordeaux mixture and Paris green were compared with a number of other combined insecticides and fungicides, and the best results were obtained where the Paris green-Bordeaux mixture was applied.

Notes are given on a number of fungus diseases which have been given some attention during the past season, and the report concludes with a discussion of the injurious action of Bordeaux mixture in apple orchards. An instance of possible injury to the foliage and fruit is cited, and experiment station and other literature is quoted to show the possibility of injury from the improper use of Bordeaux mixture, but the author concludes from his observations that it is probable that the leaf spot was caused by the scorching of the leaves by the hot sun shining through the moistened surfaces of the leaves. He does not consider it demonstrated that the injury was due to the spraying with Bordeaux mixture.

Treatment of grain for smut, C. A. ZAVITZ (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 182–185*).—The results of treating 2 varieties of oats and 2 of winter wheat with solutions of formalin, copper sulphate, potassium sulphid, etc., for the prevention of smut are described. It is shown that from the untreated seed an average of about 9 per cent of the smut occurred in the case of winter wheat and 4 per cent in the case of oats, while the crop produced from the seed which had been treated with formalin was entirely free from

smut and the percentage present in the plats the seed for which had received other treatments was greatly reduced.

A brief account is given of an experiment to test the claims that naptha powder mixed with wheat or oats will prevent the rust of those grains. The results of the investigation showed that the application of the chemical had no effect whatever in reducing the amount of rust.

Rust in oats, A. H. COCKAYNE (*New Zeal. Dept. Agr., Div. Biol. and Hort. Bul. 3, pp. 9, pls. 2*).—A general account is given of cereal rusts, after which notes are presented on the injury caused by those attacking oats, *Puccinia coronata* and *P. graminis avenæ* being of the greatest economical importance.

Numerous spraying experiments were carried out with copper sulphate, eau celeste, ammoniacal copper carbonate, Bordeaux mixture, iron chlorid, iron sulphate, and potassium bichromate. The attacks of rust are somewhat diminished by the use of Bordeaux mixture, eau celeste, and potassium bichromate, but the expense and method of treatment render it impracticable.

From the present knowledge of the subject the author states that spraying is of no practical use, and that the production of rust-proof varieties offers the most promising method of combating cereal rusts. In order to reduce the tendency to disease the author recommends care in the use of manures, particularly those containing a high amount of nitrogen, careful drainage, the removal of all weeds and wild plants which are liable to be host plants for the rusts, early sowing, and where a crop is badly infested, the burning of the straw.

Bordeaux mixture for the potato blight, C. A. ZAVITZ (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), p. 199*).—An account is given of spraying experiments with Bordeaux mixture for the control of the potato blight, in which the investigations have been carried on for a number of years. The past year 3 sprayings were given, and the average results show that there was less rot on the potatoes on which Bordeaux mixture and Paris green were used than on those where Paris green alone was applied. The 3 applications of Bordeaux mixture did not seem sufficient to prevent all the rot, and it is probable that 5 or 6 applications should be made.

The prevention of potato rot, F. PARISOT (*Jour. Agr. Prat., n. ser., 9 (1905), No. 26, pp. 821, 822*).—After describing the potato rot and its effect upon the crop, the author gives suggestions for its control.

Among the fungicides recommended he prefers the Burgundy mixture, which consists of copper sulphate 2 kg., sodium carbonate 1,500 gm., and water to make 100 liters. This should be thoroughly sprayed over the plants, using from 12 to 15 hectoliters per hectare. This fungicide is recommended on account of its great adhesiveness. When properly made a gelatinous precipitate is formed, and to get this in the best condition the mixture should be made cold. The color of the solution should be a clear blue. A greenish coloration is an indication of improper mixing.

Treatment for potato scab, C. A. ZAVITZ (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 200, 201*).—The author describes the treatment of seed potatoes with corrosive sublimate solution for the prevention of scab, and although in general the crop showed but a relatively small amount of scab, the results of the experiments indicate that the treatment will be a successful one where a scabby crop is to be expected.

The white rust of tobacco and the mosaic disease, G. DELACROIX (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 10, pp. 678–680*).—In 1894 the author in conjunction with E. Prillieux described a disease of tobacco that has since been considered as identical with the mosaic disease (E. S. R., 5, p. 1019). At that time it was claimed to be of bacterial origin, but the author now believes

that it was not the true mosaic disease but was one commonly referred to by growers as white rust. It is claimed that other investigators have not distinguished between these two diseases, and hence the confusion regarding the results of experiments.

The writer believes that the white rust is of bacterial origin, while the cause of the mosaic disease is still in dispute. The malformation and atrophy of the leaves that characterize severe cases of mosaic disease are rarely met with in France, the predominating characters being a uniform mottling of the younger leaves into different shades of green. A similar coloring is noticed on plants attacked by the white rust, except the areas are not so numerous and are more definitely limited. In addition the rust spots are rarely observed on the young leaves, but usually upon the older ones.

In the true mosaic disease the discoloration spreads over the blade of the leaf until it becomes of a uniform yellowish green color, the leaf finally drying up. In the white rust the spots are limited by a brownish margin, which becomes suberized, checking further spread. At the same time the center of the spot becomes pale, more or less blanched, and dried. The organism has been isolated and studied, its principal characters being described.

The spot disease of Iwanowski (E. S. R., 6, p. 234), the spotting of tobacco leaves reported by Sturgis (E. S. R., 11, p. 755), and the mosaic disease of a number of authors are all believed to be different from the true mosaic disease and identical with the white rust. The organism is believed to be undescribed, and the name *Bacillus maculicola* is given it.

A bacterial disease of cabbages, cauliflower, etc., G. DELACROIX (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 20, pp. 1356–1358*).—The author states that during the summer of 1904 numerous specimens of cabbage, cauliflower, Brussels sprouts, etc., were received which showed unusual coloration and lesions on the petioles of the leaves and the bases of the stems.

In a number of cases the disease appeared to have been arrested by the formation of a cork layer about the affected spots, and in such cases lateral buds developed but never attained marketable size. The disease seemed to be most troublesome on soils that had a high nitrogen content, and it is believed that this predisposed the plants to attack.

From the diseased material the author isolated an organism, to which he has given the name *Bacillus brassicævorus* n. sp. Cultures were made of the organism, and inoculation experiments showed that it was possible to produce the disease in a number of vegetables related to the cabbage. Infection experiments with filtered juice of the plants made at the same time produced lesions, but did not develop the typical form of the disease.

This organism is believed to be different from that causing black rot of cruciferous plants or the bacterial disease recently described in Canada, *Bacillus oleraceæ* (E. S. R., 16, p. 480).

A fungus of the roots of the grapevine, L. MANGIN and P. VIALA (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), No. 22, pp. 1477–1479*).—The authors describe *Stearophora radicicola*, a fungus which was observed by them during their studies on phthiriosis of the vine.

This fungus seems to attack the roots of dead or dying vines where they have been attacked by phylloxera, nematodes, etc., and the fungus quickly completes the destruction. The presence of the fungus in living tissues seemed to indicate that it also played a parasitic rôle, but the authors are not yet prepared to definitely determine this question. The fungus is technically described.

Combined treatment for the prevention of downy and powdery mildew, J. Mossé (*Rev. Vit., 23 (1905), No. 600, pp. 658–662*).—For the prevention of

these diseases by the use of a single fungicide the author recommends an alkaline polysulphid added to a verdigris solution.

Mildew and gray rot (*Rev. Vit., 24 (1905), No. 603, pp. 15, 16, pl. 1, fig. 1*).—A description is given of the attack of *Peronospora viticola* on the leaves and fruit of the grape. Upon the leaves it is called downy mildew and upon the fruit it is designated usually as gray rot. Spraying with fungicides containing some form of sulphur is recommended for the prevention of the disease.

Treatment of black rot, L. BERGEYRE (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 23, pp. 682–684*).—The efficiency of copper fungicides when properly applied is shown, and the author comments on the effect of humidity and a high temperature on the rapid spread of the disease.

Usually 4 sprayings will be found sufficient, the first of which should be applied as the buds are swelling, the second 20 to 30 days later, the third at the beginning of flowering, and the fourth after an interval of 20 to 30 days. The first and third of these applications are said to be the most important, and the necessity for the second and fourth will depend on the humidity of the atmosphere.

Black rot in Marmande, A. GUY (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 26, pp. 772–776*).—An account is given of the first and second periods of black rot invasion during 1905.

The first appearance of the fungus was noted the latter part of April, a few spots showing here and there on the leaves, and the next invasion was observed between May 27 and 29. The atmospheric conditions during this period are described. Where sprayings were made before May 5 the treatment was efficient in reducing the severity of subsequent attacks. This date corresponds to a period of low temperature preceding a rather heavy rain. Applications of fungicides after the rain when the temperature was rising rapidly were much less efficient.

A remedy for the prevention of coulure, A. BERNET (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 35, p. 252*).—For the prevention of this disease, which is probably of physiological origin, the author suggests the spraying of the vines some days before flowering with a solution containing 3 kg. of iron sulphate to a hectoliter of water. This solution checks to some extent the growth, which becomes vigorous again after the advent of warm weather, and the new growth shows no trace either of chlorosis or of coulure.

Bud rot of cocoanut palm (*Agr. News [Barbados], 4 (1905), No. 90, p. 299*).—A description of this disease was previously given by F. S. Earle (E. S. R., 14, p. 881), and since that time it has been reported as occurring in Central America and throughout most of the countries surrounding the Caribbean Sea. In some places it has become epidemic and has destroyed many plants.

Experiments carried on at the Public Gardens of Jamaica seem to indicate that spraying with Bordeaux mixture is beneficial when the applications are made before the disease has progressed too far. This beneficial use of Bordeaux mixture indicates that the disease is not as deeply seated as has been previously believed. On account of the seriousness of this disease, energetic and concerted action is needed to keep it in check.

A fungus on Para rubber leaves, H. N. RIDLEY (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 7, pp. 271, 272*).—A brief account is given of attacks of a species of Cercospora on the leaves of Para rubber plants.

The fungus causes the occurrence of pale blotches upon the leaves and when placed under conditions favorable to the growth of the parasite frequently destroys the leaves outright. Except in the case of the seedlings, the disease does not seem to do much harm, but it checks the growth of young plants and

if neglected would probably prove serious in the nurseries. The treatment o. the plants with Bordeaux mixture and the removal of the dead leaves are recommended.

The effect of different soils on the development of the carnation rust, J. L. SHELDON (*Bot. Gaz., 40 (1905), No. 3, pp. 225–229*).—The author reports the results of investigations to determine the effect of different kinds of soil on the development of the carnation rust. Previous inoculations of asparagus, onion, Dianthus, and Gypsophila with asparagus and carnation rusts seemed to indicate that the conditions which were favorable for the development of the host were also favorable for the development of the rust.

In the experiments reported upon a considerable number of inoculations were made on asparagus and Dianthus, in which plants of different ages were used and kept in the greenhouse under control from other infection. The results show that the plants that were making a vigorous growth were more susceptible to artificial infection than those that were making no apparent growth. Some carnations which were inoculated 5 or 6 times at intervals of 20 days did not show any trace of disease. These plants had grown very slowly, were slender, and produced only 1 or 2 small blossoms.

The varying susceptibility of varieties of carnations to rust is commented upon, and the author notes the difference in the period of incubation of the rust on the green and glaucous-leaved species which were inoculated at the same time.

A lack of susceptibility to inoculation is reported for seedling onions inoculated with the asparagus rust. These inoculations were made as soon as the seedlings appeared above ground and were repeated at frequent intervals until the seedlings were two months old. After this time almost every inoculation was successful.

The author attributes the failure on the part of other investigators to a lack of susceptibility of the host at the time the inoculation was made, and not to a failure of the spores to germinate or to the way the inoculation was made.

As a means of testing the effect of different soils on the period of incubation of the rust, a green-leaved pink which was known to be susceptible to carnation rust was selected. Rooted cuttings were planted in 5 different kinds of soil, ranging from almost pure sand to soils containing little sand, being made up mainly of organic matter and clay. The plants were arranged in series, and of 170 plants inoculated only 3 failed to show rust pustules in 16 to 21 days, the majority showing in 17 to 19 days.

The author summarizes the results of his investigation, the details of which are to be published later, stating that the intensity of color in the plants was directly proportional to the amount of clay in the different soils. The growth of the host was directly proportional to the amount of organic matter, nitrogen, and silt in the different soils. The period of incubation of the carnation rust, while not uniform in every instance, was in general inversely proportional to the amount of organic matter, nitrogen, and silt in the different soils, and to the growth of the host; it was directly proportional to the amount of gravel and sand in the different soils. Those soils that were found favorable for the development of the host plant also favored the development of the rust, namely, those containing the most organic matter combined with silt and clay and a small amount of sand—soils which had a high-water retentivity and which were rich in nitrogen.

A new parasite of oxalis, L. TRABUT (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 8, pp. 168, 169*).—According to the author a number of species of ornamental oxalis were observed parasitized by the broom rape (*Phelipæa*

muteli). In addition to occurring on oxalis, this same plant occurs as a parasite in Algeria upon the tomato, often causing considerable loss.

Investigations on the comparative adherence of fungicides, E. CHUARD and F. PORCHET (*Compt. Rend. Acad. Sci.* [*Paris*], *140* (*1905*), *No. 20, pp. 1354–1356*).—On account of the ease with which it is prepared, it is said that in many regions a 1 per cent solution of neutral acetate of copper is extensively substituted for the ordinary fungicides, such as Bordeaux mixture, etc. The acetate of copper is easily soluble in water, does not appear unsightly on the foliage, and its efficiency is believed to be equal to fungicides containing lime or soda.

In order to test the subject the authors made a study of the relative adhesive properties of this mixture, comparing it with Bordeaux mixture and Burgundy mixture. Eight applications were made to vines under identical conditions and on the same dates, and the amount of copper adhering to the foliage was determined. The relative amounts of copper adhering to the foliage are shown. When the strength of the different solutions is compared, the amount of copper adhering to the leaves sprayed with the neutral copper acetate solution was the greatest.

A study of sulphur fungicides, J. B. MARTIN (*Prog. Agr. et Vit.* (*Ed. l'Est*), *26* (*1905*), *No. 25, pp. 736–742*).—On account of the desirability of a combined fungicide for use against both the downy and powdery mildew of the grape, many investigators have recommended the addition of sulphur in some of its forms to Bordeaux mixture and thus treat for both diseases at one spraying. The author cautions against this practice, and cites a number of investigations which seem to throw doubt on the efficiency of such treatments. In general he claims that separate treatments will give the best results against both diseases.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Report of the entomologist, H. TRYON (*Queensland Dept. Agr. Rpt. 1904–5, pp. 125–134*).—As usual, in the author's reports, notes are given on a large number of insect and fungus pests which have attracted attention during the year. Among the more important species mention may be made of *Tephritis tryoni*, bollworm, sweet-potato weevil, cattle tick, and horse botfly. Brief notes are also given on apiculture, insectivorous birds, and fungus diseases.

Insects injurious to corn, A. R. KOHLER (*Iowa Agr.*, *6* (*1905*), *No. 3, pp. 82–86*).—The numerous insects which attack this crop are grouped according as they affect the seed after planting, the roots, and the stalk and leaves. In this discussion particular attention is given to seed-corn maggot, wireworms, northern corn-root worm, corn-root louse, bill bugs, chinch bug, army worm, and bollworm.

Report on miscellaneous cotton insects in Texas, E. D. SANDERSON (*U. S. Dept. Agr., Bur. Ent. Bul. 57, pp. 63, pl. 1, figs. 33*).—The present account of the less important insects which attack cotton in Texas is supplementary to investigations conducted by the Bureau of Entomology on the cotton-boll weevil and bollworm.

The prevalence of these species is briefly described, and the various insects discussed are arranged largely according to the nature of their attack or the part of the plant affected. Thus the classification includes leaf-eating caterpillars, insects affecting the stalks, and insects affecting the fruit. Notes are given on the habits, life history, and means of combating a large number of species, including cutworms, May beetles, locusts, beet army worms, stalk borers, snowy tree cricket, plant bugs, and sharpshooters.

Coffee-leaf miner and other coffee pests, M. T. Cook and W. T. Horne (*Estac. Cent. Agron. Cuba Bul. 3, pp. 22, pls. 5, fig. 1*).—A brief historical statement is made regarding coffee cultivation in Cuba.

At present Cuba does not produce enough coffee for home consumption. In order to increase the acreage of coffee it is desirable to have information available for coffee growers on the most important insects of this plant. The coffee-leaf miner causes a loss of about 20 per cent of the coffee crops in Porto Rico, Brazil, and Cuba. The injuries produced by the pest consist in large irregular red spots on the leaves. The insect was reared under artificial conditions in the laboratory for the purpose of studying its habits and testing remedies for its control. The larva of the coffee-leaf miner appears to feed upon the 2 upper layers of mesophyll cells beneath the epidermis.

A number of parasites of the pest are known. One artificial treatment against the coffee-leaf miner consists in picking and destroying the leaves. This is a tedious method, however, and injures the plants. Since the larvæ are inside of the leaves it is impossible to reach them immediately by insecticides. The pupæ, however, are on the outside of the leaves, and may be destroyed by the use of kerosene emulsion containing one part each of kerosene and soap per 8 parts water. Good results are obtained from the use of this remedy both in the laboratory and field.

The insect produces numerous broods and this necessitates frequent spraying. It is recommended that the application of kerosene emulsion be made regularly twice a week, beginning 6 or 8 weeks before the close of the rainy season and continuing until the commencement of the dry season. Biological and economic notes are also given on the hemisphere scale and other scale insects, mealy bugs, boring insects, case borer, nematode worms, leaf spot, *Hemileia vastatrix*, *Stilbum flavidum*, etc.

Treatment for the potato beetle, C. A. Zavitz (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 199, 200*).—For the past 10 years a comparative experiment has been in progress for the purpose of determining the relative value of potato-bug finish, Paris green mixed with plaster and water, and bug death dry and in water.

The Paris green has been used at the rate of 1 lb. in 96 gal. of water per acre or 1 lb. in 38 lbs. of plaster, while potato-bug finish was used at the rate of 20 lbs. per acre, and bug death at the rate of 32 lbs. The yield of potatoes sprayed with bug death appeared to be somewhat higher than was obtained when other insecticides were used. The cost of Paris green application per acre, however, was 60 cts., while that of bug death was $6.72.

Apple maggot, F. W. Card and M. A. Blake (*Rhode Island Sta. Rpt. 1905, pp. 197, 198*).—A number of apple maggot pupæ were placed in the soil in frames and the soil was cultivated from 7 to 10 days to a depth of 2 to 3 in. Other pupæ were placed in similar frames in which the soil was not cultivated. For some reason none of the pupæ emerged.

Winter apples from orchards in which hogs were allowed to run were comparatively free from maggots, and the results indicate that pasturing the orchard will destroy enough of the maggots for practical purposes. Fall pippins and winter apples were almost wholly free from injury, while in a tilled orchard early varieties of apples were badly injured.

Spraying for San José scale, H. E. Hodgkiss, F. A. Sirrine, and E. L. Baker (*New York State Sta. Bul. 273, pp. 473–500, pls. 4*).—In this series of experiments 5 orchards were selected in Geneva and Northville containing 596 apple, plum, and peach trees.

Applications with lime-sulphur-salt were made between November 11 and December 1. For purposes of comparison various formulas were used including

a boiled lime-sulphur-salt wash, self-boiled lime-sulphur-salt wash, lime-sulphur wash, lime-sulphur-caustic-soda boiled and self-boiled. The effect on peach-leaf curl was quite striking, only 1½ per cent of the leaves being affected on the treated trees, while on the checks 85 per cent showed leaf curl. Some of the trees were quite severely injured by self-boiled lime-sulphur-salt wash, but this injury was more than offset by the increased growth of the trees during summer.

Lime-sulphur-caustic-soda wash gave quite satisfactory results. In one orchard about 10 per cent of the peach buds were injured by the treatment. The insecticidal value of all lime-sulphur preparations was uniformly good and the injuries caused to trees were in all cases offset by increased vigor and fruitfulness. It is concluded that spraying in the fall with lime-sulphur washes is not attended with any danger.

Various kerosene-lime mixtures were used containing kerosene in quantities varying from 10 to 40 per cent, and lime in quantities varying from 20 to 80 lbs. in 50 gal. of water. Considerable difference was noticed in the different kinds of limoid and hydrate of lime which were used. The kerosene-limoid mixture containing 10, 20, or 40 per cent of oil injured trees in all cases to some extent, and even the trees which received the highest percentage of oil were well covered with young scales when examined during the next season. The kerosene-limoid mixture appeared to have no effect upon peach-leaf curl.

None of the mixtures of kerosene and limoid appeared to be uniformly effective upon the scale. This was attributed to the instability of the emulsion. On account of the variable results this insecticide appears unsatisfactory, but further experiments will be made. The technical methods for determining the amount and condition of the kerosene in the mixture are described. Applications with scalecide were made on April 26 to apple, peach, pear, and quince trees on which the buds were just swelling. The amount of oil varied from 3 to 15 per cent.

In another test an application was made on June 20 in which the amount of oil varied from 3 to 7½ per cent. Trees sprayed in the dormant season appeared to be free from living scales when examined during July and August. When 15 per cent of oil was used the trees were quite severely checked, but applications containing from 5 to 10 per cent of oil appeared to destroy from 80 to 95 per cent of the scales.

Testing spray mixtures for San José scale, F. H. Hall et al. (*New York State Sta. Bul. 273, popular ed., pp. 7, fig. 1*).—A popular summary of the above bulletin.

Some important scale insects, H. T. Fernald (*Agr. of Mass., 1903, pp. 425–437, pl. 1, figs. 5*).—A brief descriptive and economic account is given of San José scale, oyster-shell bark-louse, scurfy scale, and certain species of Lecanium.

The biology of Ceratitis capitata, A. Hempel (*Bol. Agr. [São Paulo], 6. ser., 1905, No. 8, pp. 352–354*).—The life history and economic importance of this pest are briefly discussed with notes on means of combating it.

An insect of the family Poduridæ on grapevines, H. Faes (*Chron. Agr. Vaud, 18 (1905), No. 15, p. 352*).—*Smynthurus luteus* was found in large numbers attacking the leaves of grapevines in the vicinity of Valais. Brief notes are given on the anatomy of the insect. It was found a comparatively easy matter to eradicate this pest by spraying with a mixture of soap and tobacco decoction.

Stick or leaf insects, W. W. Froggatt (*Agr. Gaz. N. S. Wales, 16 (1905), No. 6, pp. 515–520, pl. 1, figs. 3*).—Some of the more interesting points connected with the life history of these insects are discussed by the author.

Particular attention is given to *Podacanthus wilkinsoni*, which attacks all species of eucalyptus. This species inhabits a wide strip of forest land about

50 miles in length and causes such serious depredations that it has acquired the name of ringbarker. This name is due to the fact that trees are so badly injured as to be suspected of dying of ringbarking. The habits of *Extatosoma tiaratum* are also discussed.

The Gryllidæ and wingless Locustidæ, W. W. FROGGATT (*Agr. Gaz. N. S. Wales, 16 (1905), No. 5, pp. 477–481, pl. 1*).—The biology and habits of these 2 families of insects are briefly outlined and special notes are given on Australian cricket, mole cricket, and a number of locusts of economic importance.

The Black Hills beetle, with further notes on its distribution, life history, and methods of control, A. D. HOPKINS (*U. S. Dept. Agr., Bur. Ent. Bul. 56, pp. 24, pls. 2, figs. 6*).—Notes are given on the literature relating to *Dendroctonus ponderosæ*. This pest was studied in Pikes Peak forest reserve and was found not to occur so abundantly as had been supposed. It is, however, the most destructive pest of pine timber in that region.

The insect is described and notes are given on the galleries produced by it in infested trees and on its life history. The beetle apparently withstands great extremes of drought and cold. Trees struck by lightning or injured by storms or fire are most frequently attacked. The natural enemies of this pest appear to have little influence in controlling it. The only practical method suggested for the control of this pest is to cut all infested trees between the middle of October and the 1st of May.

Gall gnats injurious to osiers and willows, R. S. MACDOUGALL (*Jour. Bd. Agr. [London], 12 (1905), No. 8, pp. 499–503, figs. 5*).—The feeding habits of the larvæ of this group of willow pests vary considerably, but all known species are found in characteristic galls on twigs, flower buds, or leaves.

Detailed descriptive notes are given on *Cecidomyia saliciperda, C. salicis, C. rosaria, C. terminalis, C. heterobia,* and *C. marginem-torquens.* In general the only effective remedy consists in removing and burning the galls before the occupants escape.

A treatise on the acarina, or mites, N. BANKS (*Proc. U. S. Nat. Mus., 28 (1905), pp. 1–114, figs. 201*).—The internal and external anatomy of mites is discussed with special reference to those features which may be used in a scientific system of classification. Tables are presented to assist in the identification of the superfamilies, families, genera, and species of this group of animals. The more important species are discussed in some detail with brief reference to their economic significance.

The mosquito blight of tea, H. H. MANN (*Indian Tea Assoc. [Pamphlet] 1, 1905, pp. 19, pl. 1*).—It has been shown that on isolated fields of tea this pest may be practically exterminated in one season by pruning and spraying with kerosene emulsion. The cost of this treatment is not excessive.

A number of experiments were carried out to test the value of hand picking the insects through the agency of boys. In this work it was found necessary to assign one boy to each 5 acres of tea. The kerosene emulsion used in the author's experiments was made up of 1 to 2 lbs. of soft soap and 2 gals. of low-grade kerosene per 50 gal. of water, and was applied at the rate of 150 gal. per acre.

Preliminary experiments in dipping nursery stock, F. W. FAUROT (*Missouri Fruit Sta. Bul. 14, pp. 7*).—In the spring of 1904 some dipping experiments were undertaken with nursery stock.

Two lots of trees were divided into 3 bunches each and one of these lots was treated with lime-sulphur-salt in full strength, one-half strength, and one-fourth strength, while the other lot was dipped in formalin for one-half hour, 1 hour, and 1½ hours, respectively. The formalin solution was made at the rate of 1 pt. to 30 gal. of water, and the full strength lime-sulphur-salt wash, according to

the formula 15–15–15–50. Of the 6 bunches of trees in the two lots in the order just mentioned, the following numbers lived after setting out—22, 22, and 24 in the lime-sulphur-salt test; 24, 25, and 23 in the formalin test, as compared with 21, 23, and 25, respectively, of untreated trees.

During the next spring another test was made in which 25 plants each of apple, peach, and blackberry were dipped in full strength lime-sulphur-salt solution and 25 each of the same varieties fumigated with hydrocyanic-acid gas (1 oz. to 100 cu. ft.) for 45 minutes. Of this nursery stock, 25 apple trees, 21 peach trees, and 24 blackberry bushes treated with lime-sulphur-salt lived, while of those fumigated 24 apple trees, 25 peach trees, and none of the blackberries lived as compared with 25, 24, and 25, respectively, of untreated specimens. The lime-sulphur-salt is considered as possessing several advantages over other kinds of treatment.

Michigan laws for the protection of orchards and vineyards (*Lansing: Wynkoop, Hallenbeck, Crawford Co., 1905, pp. 11*).—A copy is given of the law recently passed in Michigan to prevent importation and spread of dangerous insects and fungus pests. The law provides for the appointment of an inspector of orchards and deputies, regulates the matter of nursery licenses within the State, and prescribes penalties for the violation of the law and its regulations.

Spraying mixtures and machinery. When and how to spray, F. L. Stevens and R. S. Woglum (*North Carolina Sta. Bul. 193, pp. 33, figs. 8; Sup., folio*).—The common insect and fungus diseases attacking fruits, garden vegetables, nursery stock, and field crops are mentioned with brief suggestions regarding methods of treating them. Notes are also given on the preparation of insecticides and fungicides, together with directions for the use of spraying apparatus and statements of the benefits obtained from spraying.

Fumigation with hydrocyanic-acid gas (*Jour. Bd. Agr. [London], 12 (1905), No. 8, pp. 496–498*).—The value of this remedy, as determined by experiments in various countries, is briefly outlined and practical notes are given regarding the strength of the gas to be used, the time of exposure, and other matters connected with successful fumigation.

Paris green, R. Harcourt (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 66–68*).—A study was made of the chemical composition of Paris green, and results of the analysis of several samples are presented.

From this chemical work it appears that the soluble arsenious acid in ordinary Paris green in Ontario market ranges from 2.11 to 4.35 per cent. The samples are not quite chemically pure, and small amounts of sand and sodium sulphate appear to be present in all cases. On the whole, however, the quality of Paris green in Ontario appears to be satisfactory. Between 100 and 120 tons are used annually in water and dry and also combined with Bordeaux mixture.

Alimentary canal of the mosquito, M. T. Thompson (*Proc. Boston Soc. Nat. Hist., 32, No. 6, pp. 145–202, pls. 6*).—The species studied in the preparation of this article were *Culex stimulans*, *C. pipiens*, a third unidentified species of this genus, and *Anopheles punctipennis*.

The anterior portion of the alimentary tract of mosquitoes contains a pharynx and antlia, both of which are pumping organs and are concerned in the removal of blood from the hosts upon which mosquitoes feed. The alimentary canal as a whole is discussed and detailed accounts are presented of the distinguishing features which appear in different parts of the organ.

Studies on mosquitoes of the genera culex and anopheles, B. Galli-Valerio and Jeanne Rochaz-De Jongh (*Atti. Soc. Studi Malaria, 6 (1905), pp. 1–25*).—The occurrence and behavior of mosquitoes under various temperature conditions are briefly stated in a tabular form.

Experiments were carried on to determine the agency of insects and other animals in destroying mosquito eggs, larvæ, and nymphs. Among the more important species in this work mention is made of *Notonecta glauca*, *Nepa cinerea*, *Naucoris cimicoides*, *Cyprinus prasinus*, and *Cobytis barbatula*. The possibility of infecting mosquito larva with various bacteria and fungi was also tested. It was found that *Aspergillus niger* and *A. glaucus* readily infect mosquito larvæ to such a serious degree that they are unable to complete their development.

The logical basis of the sanitary policy of mosquito reduction, R. Ross (*Science, n. ser., 22 (1905), No. 570, pp. 689–699, figs. 3*).—The author maintains that the agency of mosquitoes in transmitting malaria and filariasis may be considered as demonstrated. The importance of eradicating mosquitoes from infested districts is, therefore, considerably greater than would be the case if mosquitoes were considered merely as a nuisance themselves.

An attempt was made to put upon a mathematical basis the problem of mosquito extermination within areas of limited and large size. It is believed that, after extermination plans have been put in operation, the numbers of mosquitoes will be reduced not only within the area of operation but to a considerable distance outside of this area, at least equal to the usual distance of migration of the mosquitoes. This is due merely to the fact that mosquitoes are moving from place to place and tend to migrate into the areas in which extermination methods are in operation. The larger the area taken under such operations, the less noticeable will be the effect of migration of mosquitoes from outside sources.

The cattle tick, A. Löfgren (*Bol. Agr.* [*São Paulo*], *6. ser., 1905, No. 7, pp. 312–315*).—The importance of this tick as the agent in the transmission of Texas fever is briefly discussed. Animals may be rendered immune against the disease, but the systematic destruction of the tick is considered to be the best remedy.

The cattle tick in Washington and Benton counties, W. G. Vincenheller (*Arkansas Sta. Bul. 90, pp. 131–141*).—Federal quarantine has been enforced against the whole State of Arkansas although some of the northern counties have been free from ticks. On account of this fact a State quarantine law was enacted in 1899 for the purpose of preventing the infestation of these counties. This law has failed in its intent, however, for the reason that no provision was made for its enforcement and farmers did not realize the necessity of preventing the infestation of their farms with cattle ticks.

During the last few years the infestation of the previously tick-free counties has taken place quite rapidly as a result of the annual migration of berry pickers from farther south, some of whom take cattle along with them. It is believed that this reinfestation could have been prevented easily if a more active interest had been taken by the farmers concerned. Attention is called to the injurious effects of ticks upon animal industry, and a copy is given of the resolutions regarding the cattle tick adopted at the recent meeting of the association of the commissioners of agriculture of the southern States. Brief directions are given for dipping, burning pastures, and rotation in order to exterminate the ticks.

Bee keeping: Its pleasures and profits, J. B. Paige (*Agr. of Mass., 1903, pp. 399–411, pl. 1, figs. 2*).—The economic aspect of bee keeping is briefly discussed with particular reference to statistics obtained largely from the last census. The cost and profits of bee keeping in Massachusetts are considered in some detail, and directions are given regarding various practical matters connected with this subject.

Fourth annual report of the Illinois State Bee Keepers' Association (*Ann. Rpt. Ill. Bee Keepers' Assoc., 4 (1904), pp. 192, figs. 27*).—A list is given of the members of the association, together with copies of the constitution and by-laws of the association and laws relating to the protection of bees against foul brood.

The report is chiefly occupied with an account of the fourteenth annual session of the State bee keepers' association and the fourteenth convention of the Chicago-Northwestern bee keepers' association. One of the most important subjects bef re the meetings was that of foul brood, discussed by N. E. France (pp. 17–28 and 40–43), H. F. Moore (pp. 38, 39), and J. Q. Smith (pp. 78–80). These papers were discussed by various members of the associations.

The State inspector of Illinois does not destroy swarms of bees infected with foul brood as long as there is a fertile queen and bees enough to form a nucleus which can be built up by the addition of brood combs from strong colonies. Various other matters, such as wintering of bees, the use of baby nuclei, mating queens, and the manufacture of brick honey are discussed.

The rearing of queen bees, E. F. PHILLIPS (*U. S. Dept. Agr., Bur. Ent. Bul. 55, pp. 32, figs. 17*).—In order to obtain the best results in apiculture it is necessary to requeen the swarms every 1 to 2 years, otherwise the queen soon ceases t› lay a sufficient number of eggs to maintain a vigorous colony.

Under natural conditions queens are produced by feeding the larvæ on royal jelly. The occasions for queen producing are swarming, supersedure of the queen, and a queenless condition. Various methods have been devised for artificial queen rearing. Artificial starting cells are used for the reason that these may be better controlled and are more satisfactory than natural queen cells as found in the comb. An artificial wax base may be used or a wooden base lined with wax. Before being used for the first time these cells should be daubed with royal jelly on the inside. The larvæ should be transferred to the artificial cells within 1 to 3 days after hatching. Not all of these artificial cells are accepted by bees, but as many as is the case when natural cells are used.

Italian bees do not accept artificial queen raising as readily as Cyprians or Carniolans. In order to induce the bees to feed larvæ in artificial queen cells it may be desirable to use swarm boxes. About the day before the queen was to emerge the cell should be placed in an individual nursery cage so as to prevent the different queens from attacking one another. Detailed directions are given regarding all these matters as well as regarding the testing of queens, selection of drones, and other related subjects.

The enemies of bees, A. GALE (*Agr. Gaz. N. S. Wales, 16 (1905), No. 5, pp. 489–492, figs. 2*).—Directions are given regarding the methods of preventing the entrance of bee enemies into the hive. The enemies mentioned in this connection include spiders, tarantulas, bee louse, ants, bee moth, etc.

Treatise on the silkworm and mulberry, E. MAILLOT and F. LAMBERT (*Traité sur le ver à soie du murier et sur le murier. Montpellier: Coulet & Sons, 1906, pp. IX+622, pls. 3, figs. 169*).—The present volume is an elaborate treatise on the rearing of silkworms and the culture of mulberries.

The subjects discussed include the economic importance of sericulture, silkworm eggs, methods of preserving them, artificial hatching experiments, anatomy of silkworms, their diseases, the various races of silkworms, and other related insects which produce silk, as well as miscellaneous subjects related to the general topic. Especial attention is given to a discussion of mulberry culture (pp. 405–584).

A new flagellate parasite of the silkworm, C. LEVADITI (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 16, pp. 631–634, figs. 11*).—During a microscopic study of a number of silk moths the author discovered *Herpetomonas bombycis*, which is described as a new species, with brief notes on its life history.

FOODS—HUMAN NUTRITION.

Studies on the influence of cooking upon the nutritive value of meats at the University of Illinois, 1903–4, H. S. GRINDLEY and A. D. EMMETT (*U. S. Dept. Agr., Office Expt. Stas. Bul. 162, pp. 230*).—This bulletin reports experiments to determine the loss of nutrients which results when meat is cooked under different conditions in water, by pan broiling, by roasting, sautéing, frying, broiling, and pot roasting, as well as studies of the influence of the different methods of cooking upon flavor and palatability, and upon the nature of the substances which bones yield when cooked in hot water as in soup making, the work as a whole being a continuation of studies previously reported (E. S. R., 15, p. 988).

From the results obtained it appeared that "meats of different kinds and cuts may be analyzed directly and with accuracy—that is, without being first previously air dried. The soluble matter in meats may be completely removed by extraction with cold water and the preparation and analysis of such cold-water extracts is of great importance in studies of the true value of flesh foods. The total proportion of raw meat which is soluble in cold water is considerable, the average results showing that the cold-water extract contains about 2.3 per cent proteid, 1 per cent nitrogenous extractives, 1.6 per cent nonnitrogenous extractives, 0.7 per cent nitrogen, and 0.8 per cent ash. None of the fat present in the meat is dissolved by cold water. . . .

"Meats cooked by boiling are less soluble in cold water than are raw meats. . . .

"The different methods commonly followed in cooking meat in hot water vary somewhat as to time and temperature of cooking, but the resulting cooked meats are quite similar as regards composition and also as regards the proportion of their constituents which are soluble in cold water.

"Meats cooked by dry heat, as in roasting, broiling, sautéing, and frying, are on an average 2.4 times more soluble in water than boiled meats, but are only a little more than half as soluble as raw meats. . . .

"The more pronounced flavor of meats cooked by dry heat as compared with those cooked in hot water is without doubt due to the larger proportion of soluble constituents which the former contains. As regards the losses in weight when meat is cooked in hot water, the average values show that it is equal to from 10 to 50 per cent of the total weight of the fresh meat used, the average being about 34 per cent. . . .

"The fatter kinds and cuts of meat lose less water, proteid, and mineral matters, but more fat than leaner kinds of meat. The proportion of nutrients extracted in the broth is directly proportional to the length of time and the temperature of the cooking period. Different cuts of some kinds of meat behave differently as regards the nature and amount of the losses they sustain when cooked in hot water. On an average, the larger the piece the smaller the percentage losses. When meat is cooked in water at 80 to 85° C., placing the meat in hot or cold water at the start has little effect on the amount of material recovered in the broth. Beef used in the preparation of beef tea or broth has lost comparatively little of its total nutritive material, though most of the constituents which give flavor have been removed.

"As regards the composition of complete or unfiltered meat broths, the average results vary, the total solid matter containing from 1 to 10 per cent of the total quantity of meat used.

"The clear, filtered broths contained less of the important food elements, i. e., proteids and fat, than complete or unfiltered broths, but practically the same

amounts of the different extractive bodies and ash. In other words, they have less food value but fully as much flavor as the unfiltered broths, provided the fat is removed in both cases. Meat fat possesses more or less distinctive flavor, and if present modifies the flavor of the broth. Both filtered and unfiltered broths have a low food value as compared with the meats from which they are made, or as compared with meats cooked by dry heat or in hot water. This is obvious when it is remembered that broth or soup is made up largely of water.

"The small amount of nutritive material in broth or soup is chiefly in the form of organic extractives. The richness of the broth increases as the size of the pieces of meat used in making it decreases. An increase in the time of cooking also increases the amount of nutrients found in the broth. The broth is very little richer when made from bones as well as meat, the chief nutrients thus added being fat and soluble proteid. . . .

"The nutritive matter other than fat obtained [when bones are boiled as in soup making] from the small, spongy rib bones is greater than that from the larger and more compact shank bones. The shank bones, however, are generally preferred for soup making, possibly because of a certain flavor imparted by the marrow, which is so abundant. Aside from the fat content, the amount of nutrients in bones is small, and it is evident, therefore, that the bones contribute very little to the value of the broth.

"In general the various methods of cooking materially modify the appearance, texture, and flavor of meat and hence its palatability, but have little effect on total nutritive value. Whether it be cooked in hot water, as in boiling or stewing, or by dry heat, as in roasting, broiling, sautéing, or frying, meat of all kinds has a high food value when judged by the kind and amount of nutritive ingredients which are present."

The chemistry of flesh. III, A study of the phosphorus content of flesh, A. D. EMMETT and H. S. GRINDLEY (*Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 25–63*).—Continuing investigations of the chemistry of meat (E. S. R., 16, p. 488), the results of an extended series of studies on phosphorus constituents are reported.

The Hart-Andrews method of separating and determining the inorganic phosphorus, the authors conclude, gives satisfactory results in aqueous extracts of flesh after the coagulable proteids have been removed. A difference in the phosphorus content of the flesh of beef and veal was noted. In the case of beef 75 per cent of the total phosphorus was soluble in cold water, one-fourth of this being soluble organic phosphorus.

With veal 64 per cent of the total phosphorus was soluble in cold water, one-sixth of this being soluble organic phosphorus. The ratio of soluble organic to soluble inorganic phosphorus in beef was 3:5 and in veal 3:9. Phosphorus formed 23.4 per cent of the ash in beef and 20.2 per cent of the ash in veal, soluble phosphorus constituting 17.8 and 12.8 per cent, respectively, of the ash in the 2 sorts.

"The percentage of fat in the different cuts of veal has little influence upon the total phosphorus content. The cuts of veal which are nearest the bony structure apparently contain more insoluble phosphorus than the other cuts. The different methods of cooking flesh give products which differ decidedly as to the quantities and the nature of the phosphorus contents. The water-soluble organic phosphorus of the aqueous extracts of flesh is not in combination with the coagulated proteid, with the albumoses or with the peptones. The soluble organic phosphorus compounds in flesh are quite stable even in the presence of considerable excess of nitric acid."

Artificial digestion experiments, E. GUDEMAN (*Jour. Amer. Chem. Soc., 27 (1905), No. 11, pp. 1436–1442*).—From artificial digestion experiments with

egg albumen digested with pepsin and pancreatin in which the effect of a number of preservatives was studied, including salicylic, benzoic, and boric acids and salts; sulphurous acid; saccharin; sugar; vinegar; ethyl and methyl alcohol; salt; formaldehyde; smoke; condensed smoke; creosote; and phosphoric, hydrochloric, and nitric acids, the following conclusions were drawn:

"In an acid medium, the only preservatives or condiments used in these tests which retarded peptic or pancreatic digestion, when in proportion of 1:400 or less, were salicylic acid, formaldehyde, smoke, condensed smoke, and creosote. Of these, salicylic acid does not retard the digestion when present in proportion of 1:1000.

"(a) In a neutral medium acid, preservatives and acid condiments increase the factor of digestibility, due to a change of the neutral medium to an acid one, and digestion proceeds normally as in the acid medium; (b) alkaline preservatives change the character of the medium and the results are abnormal, the action of the ferment being retarded.

"In an alkaline medium, preservatives and condiments react abnormally, depending on the degree of alkalinity, the action of the ferments being retarded."

Similar tests were made with a number of mineral, animal, vegetable, and synthetic colors. According to the results reported of the colors used "only ultramarine, burnt sienna, chrome yellow and ponceau 2R. affect artificial digestion with pepsin when used in quantities of 1 part of the color or less to 400 parts of the food. The results also indicate that the synthetic colors are less active than animal and mineral colors and not more active than vegetable colors. Vegetable and synthetic colors are directly digested by pepsin and by pancreatin, and when the amount of color exceeds 1 part to 200 a correction is necessary, increasing the factor of digestibility 10 to 40 points.

On Folin's theory of proteid metabolism, D. N. PATON (*Jour. Physiol., 33 (1905), No. 1, pp. 1–11, figs. 3*).—From experimental and other data presented, the author concludes that the theory of proteid cleavage advanced by Folin (E. S. R., 17, p. 167) regarding protein metabolism should not be based too exclusively on the distribution of nitrogen in the urine of the subjects examined, but that the possibility of urea being an end product of both exogenous and endogenous metabolism should be considered.

Strength and diet. A practical treatise with special regard to the life of nations, R. RUSSELL (*New York and Bombay: Longmans, Green & Co., 1905, pp. 649*).—A vegetarian treatise.

Cooking by cold: Some studies, E. CUTTER (*Dietet. and Hyg. Gaz., 22 (1906), No. 2, p. 79*).—Tests are reported from which the author concludes that freezing potatoes, onions, cranberries, and squashes changed some starch into dextrose.

The effects of high external temperatures on the body temperature, respiration, and circulation in man, A. E. BOYCOTT and J. S. HALDANE (*Jour. Physiol., 33 (1905), No 1, Proc. Physiol. Soc., 1905, p. XII*).—In experiments with man the body temperature in still air was found to rise above normal when the wet-bulb thermometer rose above 31° C., while it remained normal whatever the external temperature might be, provided the wet-bulb thermometer did not rise above 31°.

"The more the wet-bulb thermometer rose above 31° the more rapidly did the body temperature rise. In moving air the wet bulb thermometer could be allowed to rise to about 35° or a little higher without the body temperature rising above normal. With rise of body temperature a marked fall in the alveolar CO_2 pressure was observed. With rise of body temperature there was a very marked increase in the pulse rate, along with a slight or tolerably marked rise in the blood pressure."

Rice flour sold in France (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 22, pp. 503–506*).—Notes on the use of rice flour as an adulterant of wheat flour.

The carbohydrates of marine algæ and products made from them, J. König and J. Bettels (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 8, pp. 457–473*).—From an extended study of edible birds' nests and of marine algæ and their products, agar-agar, and nori, the conclusion was reached that the edible birds' nests have an entirely different composition from the marine algæ products to which they have much resemblance.

In contrast to the marine algæ products the edible birds' nests contain no galactan and only a small amount of carbohydrates as a whole (15 to 20 per cent). On the other hand, the percentage of nitrogenous material resembling mucin is high (50 to 60 per cent). It may be said, therefore, that edible birds' nests are a true animal product.

Barley grits and pearl barley from sulphured grain, T. Wetzke (*Ztschr. Öffentl. Chem., 11 (1905), p. 22; abs. in Hyg. Rundschau, 15 (1905), No. 23, p. 1219*).—Examination of a number of samples showed that the amount of sulphurous acid remaining in grits and pearl barley made from sulphured grain was very small and the author believes therefore that such goods would not be unwholesome.

Cheese as an article of diet. Fancy cheeses, J. G. McMillan (*Jour. Dept. Agr. Victoria, 3 (1905), No. 10, pp. 703–713, pls. 2, figs. 4*).—The author points out that cheese is a very nutritious food from the standpoint of protein and energy. Data regarding the composition of different sorts of cheese are quoted and the possibilities of increasing the local consumption of cheese and other questions are spoken of. The author believes that the manufacture of fancy cheeses would prove profitable in Victoria, and detailed directions are given for making a number of sorts.

Tannin in coffee, C. D. Howard (*N. H. Sanit. Bul., 2 (1906), No. 10, pp. 163–165*).—Analyses of coffees from which it is claimed tannin or tannin and caffein has been removed were made, as well as of ordinary coffee and coffee chaff, with a view to ascertaining whether the removal of the chaff or other special treatment diminishes the tannin content as is frequently claimed.

The coffee chaff examined contained 5.98 per cent caffetannic acid, a mixture of Java and Mocha coffee 11.17 per cent, and the specially prepared coffees from 7.61 to 11.04 per cent. In the author's opinion the figures show plainly that the exclusion of the chaff would not mean freedom from tannin. "The only practicable method by which the caffetannic acid could be extracted is that of treatment with hot water, and this process would involve the simultaneous removal of the caffein."

Chemical and sanitary studies of oils used as food in Riga, F. Ludwig (*Farm. Zhur. [St. Petersb.], 43 (1904), p. 209; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 9, p. 562*).—The results of analyses of a number of samples of hemp seed oil, sunflower seed oil, mustard seed oil, and Provence oil are reported. All were found to be fresh and unadulterated.

Condiments and their active principle, P. Martens (*Pure Products, 2 (1906), Nos. 1, pp. 9–13; 2, pp. 62–67*).—Data are summarized regarding the composition of spices, tea, coffee, tobacco, and other condiments and stimulants with special reference to the essential oils, alkaloids, and other bodies to which their specific flavor or action is due.

Experiments in blanching vegetables, T. Zschokke (*Landw. Jahrb. Schweiz, 19 (1905), No. 9, pp. 619, 620*).—When vegetables are canned on either a large or a small scale it is customary to cook them in water until soft, i. e., to blanch them before processing in cans. This preliminary cooking removes more

or less coloring matter and nutritive material also, which is to be regarded as a loss since the water is not used.

Comparative tests were, therefore, made with carrots, beans, and peas to see whether the losses could not be avoided if the vegetables were steamed. The samples cooked by steaming were found to be soft 3 to 5 minutes before the samples cooked in water. The water in which the vegetables were boiled was cloudy and of a green color in the case of beans and peas, and of a yellow color in the case of carrots. When the vegetables were steamed, the water in the steamer was neither cloudy nor colored.

As shown by analyses of the water in the 2 cases, the total amount of material extracted from boiled carrots was 3.75 per cent, peas 3.31 per cent, string beans whole 1.008 per cent, and string beans cut up 1.208 per cent. In the case of the steamed vegetables the quantities were carrots 0.69 per cent, peas 0.688 per cent, string beans whole 0.286 per cent, and string beans cut up 0.227 per cent. The amount of protein, nitrogen-free extract, and mineral matter (potassium oxid and phosphoric acid) in the dry matter was determined, and nitrogen-free extract was found to be the principal constituent.

Results of examination of canned vegetables, O. Schütte (*Pure Products, 2 (1906), No. 1, pp. 21–26*).—A report of the examination of 19 samples of canned asparagus, peas, string beans, corn, tomatoes, and mushrooms. All but 3 of the samples were American goods. Most of the samples were of good quality and free from added preservatives. The 2 samples of mushrooms examined (French products) had a putrid odor and were badly decomposed, though they were free from bacteria. In the author's opinion they were unfit for use.

The dangers attending the use of spoiled canned goods are spoken of.

Regarding canned asparagus, the author notes that "while some degree of corrosion can scarcely be avoided when asparagus is preserved in tins, the discoloration of the vegetable indicates a contamination too serious to be overlooked; at any rate the pieces showing a marked discoloration should not be used."

Report on food products for 1905, B. W. Kilgore (*Bul. N. C. Dept. Agr., 26 (1905), No. 12, pp. 35*).—In addition to a general summary of the work undertaken in 1905 under the provisions of the State pure-food law, the bulletin contains the following special articles: Vinegar, Examination of Canned Corn, Examination of Olive and Other Table Oils, and Malts, Beers, Phosphates, Ciders, Tonics and Bitters, by W. M. Allen; and Maple Sugar and Sirup, by J. M. Pickel.

The total number of samples of food products and beverages examined was 179, and of these 40.22 per cent were found to be adulterated. Of the 52 samples of vinegar examined 34 were found to be as represented. Twenty-nine samples of canned corn were tested for chemical preservatives but none was found. Of the 14 samples of table oils examined, 12 sold as olive oil were apparently true to name. Two samples were labeled salad oil and apparently consisted largely, if not entirely, of cotton-seed oil. Thirteen out of the 15 samples of maple sirup examined were found to be adulterated—12 with cane sugar, while one, as stated on the label, contained glucose. Of the 2 samples of maple sugar examined one was found to be adulterated.

Report of food and drug inspection, C. D. Howard (*N. H. Sanit. Bul., 2 (1906), No. 10, pp. 158–163*).—A number of samples of oysters, cider vinegar, mincemeat, chocolate candy, and drugs were examined.

"When the work of examining oysters was commenced at the State Laboratory of Hygiene 2 years ago, we found 44 per cent of the samples collected as fresh oysters to be preserved with borax or preservaline. Several cases of ill-

ness were reported from their use. The gradual reduction of this unlawful adulteration to 7 per cent, in the face of protestations from the wholesale houses that the business could not be carried on without using preservatives, shows their claims to be false, and exhibits in a limited measure the results of the work."

The fate of boric acid in the body, E. ROST (*Arch. Internat. Pharmacod. et Thér., 15 (1905); abs. in Brit. Med. Jour., 1906, No. 2352, Epit., p. 16*).—The investigations reported led to the conclusion that the kidneys are practically the only channels by which boric acid is eliminated, the quantity occurring in the saliva, milk, and feces being very small.

Of the total amount of boric acid administered, 50 per cent was eliminated in the urine in 12 hours. Boric acid does not disappear from the body as rapidly as has been thought, since the remaining portion was not excreted for 3 or 4 days, and if boric acid be repeatedly taken, in the author's opinion, it may accumulate in the body.

The necessity for a national pure-food law, E. GIRARD (*Dietet. and Hyg. Gaz., 21 (1905), No. 11, pp. 656–658*).—In connection with an address on the need of a national pure-food law delivered before the annual convention of the International Stewards' Association, the author states that when pigs and other animals were given food artificially colored in the same way and to the same extent as human foods they failed to make satisfactory gains in weight and showed other unfavorable symptoms, whereas such was not the case with control animals fed food without artificial coloring matter and preservatives. Some of the animals were shown. When the test was reported a pig receiving pure food weighed 140 lbs. and an animal which had received the preservative and coloring matter weighed only 85 lbs.

Foods and food control, W. D. BIGELOW (*U. S. Dept. Agr., Bur. Chem. Bul. 69, rev. ed., pts. 1–8, pp. 704*).—This compilation of the State and Federal laws regarding foods and food control has been revised to July 1, 1905.

ANIMAL PRODUCTION.

Licensed commercial feeding stuffs, 1905, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Bul. 130, pp. 1–50*).—The licensed feeds examined in 1905 included linseed meal, cotton-seed meal, gluten feeds, hominy feeds, corn and oat feeds, oat feeds, dairy feeds, calf feeds, molasses grains, and meat meal and other poultry feeds.

The unlicensed feeds, feeds not subject to license, and the miscellaneous materials examined included ground rice hulls, mixed rice feed, rice bran, rice middlings, speltz hulls, dried brewers' grains, molasses feeds, malt sprouts, proprietary poultry feeds, blood flour, bone meal and other poultry feeds of animal origin, distillers' grains, molasses grains, gluten feed, wheat bran, wheat middlings, mixed bran and shorts, Red Dog flour, ground corn and oats, corn meal, oats (whole and ground), barley, barley bran, barley feeds, ground barley and oats, rye shorts, ground flaxseed, and wheat screenings.

One of the so-called cereal oil meals examined was found to consist of finely ground rice hulls apparently impregnated with a cheap oil, either rape seed oil or rice oil.

"Twenty-four samples out of 129 collected, of 45 different brands, were found deficient in protein and fat, 58 in protein alone and 10 in fat alone; that is, 82 samples, or 64 per cent of the total number [of licensed feeds], contained less protein than guaranteed . . . and 34 samples, or 26 per cent of the total number, contained less fat than the guaranty. . . . Deficiencies occurred in the

case of 45 different brands. Since samples of 58 different licensed brands were collected and analyzed during the year, we find that 69 per cent of the brands (40 different brands) were deficient in protein and 33 per cent (19 different brands) were deficient in fat. These figures are strikingly large and furnish conclusive proof that the various manufacturers of licensed feeding stuffs do not pay much attention to the chemical composition of the feeds which they put on the market in this State and generally place their guaranties for valuable food components considerably higher than they have reason to expect the feeds will reach. The figures also give evidence of the indifference of buyers of feed as to whether the guaranties of the manufacturers are met or not. No permanent improvement in this respect can be hoped for until purchasers of concentrated feeds post themselves more thoroughly in regard to the composition of the various feeds and come to appreciate the value of high-grade feeding stuffs. When this change occurs, the cost of the feed will becomes of less importance than it is now, for buyers will realize that feeds of good quality can not be sold at cheap prices. . . . No serious adulterations of concentrated feeding stuffs are practiced in this State, so far as we have been able to ascertain; the admixture of screenings to mill feeds, especially bran, is still practiced by a few mills, but the quality of the mill feed sold in our State is, on the whole, of a high grade."

The inspection of feeding stuffs in Wisconsin and some of the results so far obtained, F. W. Woll (*Wisconsin Sta. Bul. 130, pp. 51–70*).—The importance of laws regulating the sale of feeding stuffs, the operation of the Wisconsin State law, and similar questions are spoken of, as well as the character of the feeding stuffs sold in Wisconsin and related topics. While a large proportion of the feeding stuffs, including the wheat bran and other by-products which are so important, are of good quality, many instances of adulteration were found. "Ground rice hulls have recently been introduced into the State and, but for prompt action on our part, would be likely to have found their way into the ground feed on our market and may do so yet in spite of our efforts. . . . As rice hulls are a dangerous feed and we have records that cattle have died after eating large quantities thereof, we thought it our duty to call public attention to the danger of these ground hulls finding their way into mixed feeds sold in the State and to put our farmers and others on their guard."

Foods for live stock (*Jour. Jamaica Agr. Soc., 9 (1905), No. 12, pp. 447, 448*).—Analytical data regarding composition of local-grown corn and guinea corn are reported, and the importance of local feeding stuffs is discussed. It is pointed out that guinea corn is an important stock feed, and as a forage crop it is claimed that it is more valuable than corn. "Hay grass," it is said, is also a valuable feed, the young crop being especially rich in protein.

"Bamboo leaves are another very good fodder. If in places where drought in the spring is feared, the clumps that often dot pastures were at the end of the October seasons cut down and fired, from the roots would spring up a mass of rich vegetation, producing fodder through the driest weather. St. Mary grass and the coarse guinea grass, sometimes called Cow Grass, are more nutritious than is generally thought and form valuable fodders, not of much less value than the best guinea grass."

Barley, F. Barnstein (*Landw. Vers. Stat., 63 (1905), No. 3–4, pp. 275–305, figs. 18*).—A summary of data on the origin and distribution, chemical composition, digestibility, feeding value, botanical structure, uses of barley and barley products, and related questions.

Digestion experiments, W. P. Gamble (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 100–103*).—The composition and digestibility of

green or uncured corn, field-cured corn, and silage were studied, the average coefficients of digestibility obtained with steers being as follows:

Average coefficients of digestibility of corn products—Experiments with steers.

	Dry matter.	Protein.	Fat.	Nitrogen-free extract.	Crude fiber.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Green or uncured corn fodder	74.60	73.47	83.02	76.08	75.28
Field-cured corn fodder	72.57	73.27	85.73	74.92	71.70
Corn silage	70.08	66.24	82.48	71.86	74.23

"The loss sustained when corn is cured in the fields and in the silo is about equal. There is a decrease in the digestibility of corn fodder in curing it. There is little difference in the digestibility of field-cured corn and ensilage.

"The foregoing conclusions lead to the belief that silage is the best form in which the farmer can save his fodder corn; because, first, it is succulent and palatable, and the animals eat it much more readily than field-cured corn; second, the cost of putting corn into the silo is but slightly greater than that of curing it in the field; third, silage is always in a convenient form to feed; and, finally, the loss in the silo is not likely to be as great as the loss in the field, where the wind blows a certain amount of it away. A further loss is sustained in that part of the fodder frozen to the ground and any bundles that fall are almost, if not entirely, rendered useless as food."

Brief statements are made regarding the work at the college.

Investigations on the nutritive value and digestibility of cotton-seed meal containing an abundance of hull and dried yeast residue, F. Honcamp, M. Popp, and J. Volhard (*Landw. Vers. Stat., 63 (1905), No. 3-4, pp. 263-274*).—In experiments with sheep the average coefficients of digestibility for undecorticated cotton-seed meal were: Protein, 73.2 per cent; ether extract, 100 per cent; nitrogen-free extract 54.6 per cent, and crude fiber, 23.1 per cent; and for dried yeast residue: Protein, 86.6 per cent, ether extract, 38.2 per cent, and nitrogen-free extract, 81.5 per cent.

Experiments on the comparative digestibility of meadow hay and oat straw by cattle and sheep, O. Kellner et al. (*Landw. Vers. Stat., 63 (1905), No. 3-4, pp. 313-319*).—Meadow hay was more thoroughly digested by steers than by sheep, as were also the oat straw constituents, with the exception of ether extract.

The digestibility of different materials used to absorb molasses, with special reference to the metabolism of mineral matters, T. Pfeiffer and A. Einecke (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 4, pp. 547-565*).—Since wood meal and peat meal are both used as carriers of molasses in commercial feeding stuffs, the influence of these materials on the digestibility of rations was tested with sheep.

It was found that wood meal lowered the coefficients of digestibility of the ration, no marked difference being observed between raw wood meal and that which had been cooked under pressure. As in earlier work (E. S. R., 16, p. 291), it was found that peat meal contains only small amounts of digestible nutrients. In connection with the work the balance of income and outgo of sodium and potassium was determined.

Spontaneous combustion of hay, K. H. M. van der Zande (*Milch Ztg., 34 (1905), No. 45, pp. 550-552, figs. 2*).—The investigation reported has been previously noted (E. S. R., 16, p. 1004).

On the contents of lime and phosphoric acid in feed rations, S. HALS (*Norsk Landmandsblad, 24 (1905), No. 45, pp. 567, 568*).—The author shows that concentrated feeds as a general rule are low in lime and high in phosphoric acid, while the opposite holds true with coarse feeds. Where large quantities of concentrated feeds are fed, there is therefore a danger of supplying too little lime for the needs of the animals.

In the case of milch cows producing 10 kg. of milk per day, the lowest quantities required would be about 70 gm. of lime and 45 gm. of phosphoric acid. This deficiency can be made good by adding mineral matter to the ration. For supplementing rations relatively low in lime, precipitated dibasic calcium phosphate is recommended as superior to bone meal, bone ash, or similar very indigestible materials.—F. W. WOLL.

Experiments in calf feeding (*Queensland Agr. Jour., 16 (1905), No. 3, pp. 252–255*).—The feeding value of 3 sorts of commercial calf feeds was studied in comparison with pollard, the different feeding stuffs being fed with skim milk. In 2 of the tests the calves were finished on a mixture of whole and skim milk. Generally speaking, the gain on pollard and skim milk was greater than on commercial feeds and was more cheaply made.

The utilization of skim milk for calf feeding, A. PIROCCHI (*Rev. Gén. Lait, 5 (1905), No. 3, pp. 49–58*).—Using calves 8 to 41 days old, the value of rice flour, corn meal, and starch as supplements for skim milk were studied. The greatest gain per head per day was 0.97 kg. by one of the calves on maize meal and the smallest gain, 0.76 kg., by one of the calves on rice meal. The flesh of the calves fed maize and flour was superior to that of the calves fed rice flour from a market standpoint.

Cattle feeding (*Verslag. en Meded. Afdeel. Landb. Dept. Landb., Nijv. en Handel, 1905, No. 6, pp. 63, map 1*).—This summary of information on cattle feeding contains the following articles: Government Methods Adopted in 1904 for Encouraging the Cattle Industry, by F. B. Löhnis; The Improvement of Cattle, by H. M. Kroon; and The Cattle Industry of Belgium, by S. Koenen and H. Mayer Gmelin.

Experiments in steer feeding, J. A. CRAIG and F. R. MARSHALL (*Texas Sta. Bul. 76, pp. 23, figs. 4*).—Tests were made with 8 lots of 5 cattle each in 1903 and 8 lots of 5 and 2 of 19 each in 1904, the 2 larger lots being fed on pasture. Materials of interest to southern feeders, namely, rice by-products, hay of different sorts, and molasses were studied, the special rations being compared with a standard ration of cotton-seed meal and cotton-seed hulls. The lots on pasture were fed for 196 days; the others 60 to 100 days.

In the first test with rice bran, this material replaced cotton-seed meal in the proportion of 3:2, and cotton-seed hulls constituted the coarse fodder. The average daily gain per head was 2.17 lbs. and the cost of a pound of gain 4.6 cts. On cotton-seed meal and hulls similar values were 2.21 lbs. and 4.61 cts. The average daily gain on rice bran substituted for cotton-seed meal in about the proportion of 2:1 was 2.98 lbs. and the cost of a pound of gain 3.14 cts. as compared with 2.88 lbs. and 3.23 cts. on cotton-seed meal and hulls.

When rice bran was added to a ration of cotton-seed meal and hulls, the quantity of the bran being nearly half that of the meal, the average daily gain was 3 lbs. as compared with 2.6 lbs. on cotton-seed meal and hulls only, the cost of a pound of gain in the 2 cases being 3.9 and 4.1 cts.

Substituting rice polish for a part of the cotton-seed meal in a standard ration resulted in an average daily gain of 2.29 lbs., the cost of the gain being 4.5 cts. per pound; that is, the gain was somewhat greater and the cost less

than the values reported for a ration of cotton-seed meal and hulls. The maximum amount of rice polish eaten was 2.5 lbs. per head per day.

The feeding value of rice hulls was also studied. It was the intention to substitute these for cotton-seed hulls, but the cattle would not eat a sufficient quantity and the ration finally selected consisted of rice hulls, cotton-seed hulls, cotton-seed meal, and rice bran. The average daily gain was 1.86 lbs. and the cost of a pound of gain 4.35 cts. On a similar ration without the rice hulls the average values were 2.17 lbs. and 4.6 cts.

When sorghum hay, cowpea hay, and peanut hay were tested as substitutes for cotton-seed hulls, the grain ration, consisting of cotton-seed meal and rice bran, the greatest gain, 2.35 lbs. per head per day, was obtained with sorghum, the cost of a pound of gain being 4.6 cts., similar values on a ration of rice bran, cotton-seed meal, and cotton-seed hulls, selected for comparison, being 2.98 lbs. and 3.1 cts. The least satisfactory gain, 1.86 lbs. per day at a cost of 4.5 cts., was obtained with peanut hay. A test with prairie hay was also made, but as it covered only 4 weeks final conclusions were not drawn. The average daily gain was 3.44 lbs. per head.

In a 100-day trial, alfalfa hay and corn-and-cob meal, a typical corn-belt ration, were compared with cotton-seed meal and hulls, a typical cotton-belt ration, the average gain per head in the 2 cases being 2.53 and 2.21 lbs. and the cost of feed per pound of gain 7 and 4.6 cts. "It will be seen . . . that alfalfa and corn-cob meal produce slightly more satisfactory gains, but, under conditions existing in the greater part of Texas, it will hardly be possible to make a pound of gain as cheaply as on a ration consisting of cotton-seed meal and hulls."

The average daily gain on a ration of molasses with cotton-seed meal and hulls was 3.1 lbs. per head at a cost of 4.52 cts. per pound as compared with 2.59 lbs. and 4.66 cts. on a similar ration without the molasses.

Shelled corn, ear corn, and cotton-seed meal supplementing pasturage gave better results than the corn alone, the average daily gain in the 2 cases being 1.1 lbs. and 0.87 lb. and the cost of a pound of gain 3.6 and 4.6 cts.

In these trials part of the animals fed were yearlings and the others two-year-olds. "Yearling steers in comparison with two-year-old steers on rations of cotton-seed meal and hulls made about the same gain at a little cheaper cost. The two-year-old steers gained 2.59 lbs. per head daily and the yearlings 2.21 lbs."

Silage, hay, and stover in beef making, A. M. SOULE and J. R. FAIN (*Virginia Sta. Bul. 157, pp. 35–64, figs. 10*).—Corn silage, corn stover, and timothy hay were compared, as were also linseed meal and cotton-seed meal, supplementing corn-and-cob meal, the rations being so arranged that each of the coarse fodders was fed with the 2 grain mixtures.

The 6 lots used in the trial were each made up of 5 steers and 5 heifers, and the test covered 180 days. The largest gain, 1.59 lbs. per animal per day, or 1.66 lbs. per steer and 1.51 lbs. per heifer, was obtained with the lot fed silage with corn-and-cob meal and linseed meal. The lot fed silage with cotton-seed meal in addition to corn-and-cob meal did not do as well, gaining only 1.33 lbs. per head per day on an average, or 1.35 lbs. per steer and 1.3 lbs. per heifer. These two rations, the authors point out, were decidedly superior to the others tested.

The ration containing shredded corn stover and linseed meal gave an average daily gain of 0.93 lb. per head, and that containing shredded corn stover and cotton-seed meal a gain of 1.01 lbs. On the ration containing timothy hay and corn-and-cob meal with linseed meal and cotton-seed meal, respectively, the gains were 1.15 lbs. and 1.05 lbs. per head per day.

Considering the results as a whole, the silage-fed cattle made an average gain of 1.46 lbs., the stover-fed cattle 0.97 lb., and the hay-fed cattle 1.10 lbs. per head per day.

"There was a difference of from 0.3 to 0.5 of a pound of gain per head per day in favor of the silage-fed cattle. They also finished out better and in any discriminating market would certainly bring a better price than the dry-fed cattle.

"Of the three forms of roughness fed, the silage was eaten with the greatest relish and there was absolutely no loss, whereas with the stover the loss amounted to 13.5 per cent, and with hay 4.16 per cent. Where a larger number of animals are fed this would make a considerable difference in the cost of ration, except that the shredded stover can be utilized to advantage for bedding.

"That the cattle fed were not of a satisfactory quality is evidenced by these results. . . .

"Considered on the basis of the content of digestible protein there is little to choose between linseed meal and cotton-seed meal for balancing up the corn-and-cob meal, which must of necessity constitute the basis of a ration for beef cattle in the South. The relative cost of the foods will determine which one to select."

Draft cattle, M. Ringelmann (*Jour. Agr. Prat., n. ser., 11 (1906), No. 2, pp. 43–48*).—A summary of information regarding the feeding of draft cattle, with special reference to the rations fed and related topics.

Sheep feeding experiments, W. Bruce (*Edinb. and East of Scot. Col. Agr. Bul. 8, pp. 1–34*).—A test previously reported on the comparative value of different kinds of cotton-seed cake and other grains, the second experiment in all practical details confirming the earlier work (E. S. R., 17, p. 68).

Live stock, G. E. Day (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 136–142*).—Brief statements are made regarding the farm animals kept and sold, and feeding experiments with pigs are reported.

In a study of blood meal, tankage, skim milk, and skim milk and tankage, fed with mixed meal as compared with mixed meal alone, made with 5 lots containing 7 or 8 pigs, it was found that the gain ranged from 122.4 lbs. per pig on meal only to 163.8 lbs. on skim milk, tankage, and mixed meal. The meal ration was most expensive, a pound of gain costing 4.81 cts., and the tankage and meal ration least expensive, a pound of gain costing 4.29 cts. This is a duplicate of a test previously reported (E. S. R., 17, p. 173) and consumed over 5 months.

In a study of pen feeding *v.* pasturage, a lot of 8 pigs was turned on a rape pasture and fed a light grain ration in comparison with the lot fed meal indoors in the above test. The pasture-fed lot made an average gain of 108.6 lbs. per pig at a cost of 5.51 cts. per pound. "Though the pigs on the exclusive meal ration made somewhat expensive gains, those on pasture proved a great deal more expensive. Pasturing proves very satisfactory for matured or comparatively well matured pigs, and is beneficial in promoting health and general vigor, but for young, growing pigs all our work goes to show that it is vastly more economical to restrict the amount of exercise and to feed the pigs green food with their meal ration."

In connection with the feeding experiments, data are recorded regarding the cost of raising pigs. The average cost of raising pigs 6 weeks old was $1.31 per head, and the total cost when finished for market $4.52 per 100 lbs. In another instance recorded, the cost when finished was $3.86 per 100 lbs. These values are regarded as tentative.

Pig feeding experiments, C. L. Beach and H. L. Garrigus (*Connecticut Storrs Sta. Bul. 39, pp. 29–37, figs. 4*).—In the first of the tests reported

grain and skim milk each fed alone were compared with grain and skim milk 1:4 and 1:8, the test being made with 4 lots of 3 pigs each and covering 86 days. The average daily gain ranged from 0.47 lb. on grain only to 1.38 lbs. per head on grain and skim milk 1:4. The cost of a pound of gain ranged from 4.2 cts. on the last mentioned ration to 5.48 cts. on skim milk only.

Four feeding trials were reported each with 2 lots of 3 or 4 pigs, one lot being fed grain and skim milk 1:3 or 4 and the other in the proportion of 1:7 or 8. The average duration of the tests was 114 days. With the larger proportion of skim milk the average daily gain was 1.10 lbs. per head and with the smaller proportion 1.27 lbs., the cost of a pound of gain in the 2 cases being 4.45 and 4.95 cts. Considering all the lots the average amount of feed required per pound of gain was 2.53 lbs. grain and 10.86 lbs. skim milk. The gains made by the pigs in different periods were considered. In the case of most of the pigs the relation of dressed to live weight was recorded and found to be 75 per cent on an average.

Fattening pigs and wintering brood sows on alfalfa and a grain ration, H. R. Smith (*Nebraska Sta. Press Bul. 20, pp. 4*).—The value of cut alfalfa hay and ground alfalfa hay as substitutes for grain was tested with 8 lots of 7 pigs each, the rations consisting of corn meal, alone and with shorts, bran, cut alfalfa hay, and ground alfalfa hay, the proportions in which the other feeding stuffs were combined with the corn meal being 3:1 and 1:1.

In the 12 weeks of the test the average daily gain per pig ranged from 0.8 lb. on corn meal and bran 3:1 to 1.096 lbs. on corn meal and shorts 3:1. However, nearly as large gains were made when alfalfa hay formed a part of the ration amounting to 1.071 lbs. and 1.062 lbs., respectively, with corn meal and cut alfalfa hay 3:1 and corn meal and ground alfalfa hay 3:1. The feed required per pound of gain ranged from 4.06 lbs. with corn meal and shorts 3:1 to 5.89 lbs. with corn meal and bran 3:1, and the cost of a pound of gain from 2.62 cts. with corn meal and cut alfalfa hay 3:1 to 3.96 cts. with corn meal and ground alfalfa hay 1:1.

"The largest daily gains were made on three-fourths corn and one-fourth shorts, but a gain practically equivalent was made at a lower cost where [a like proportion of] either cut or ground alfalfa was substituted for shorts in the ration. The cheapest gains were made on corn and cut alfalfa. Bran does not prove equal to either shorts or alfalfa when fed as one quarter of the ration to pigs.

"A ration three-fourths corn and one-fourth alfalfa produces greater gains than when one-half alfalfa is fed. Where alfalfa is raised on the farm, and when there is no particular need to hasten growth in the pigs, a ration one-half alfalfa hay and one-half corn may give cheaper gains than when a heavier corn ration is fed.

"Hogs which have been raised largely on alfalfa pasture will learn to eat the hay in winter without cutting with a machine and to depend largely upon it where only a limited grain ration is fed, but a ration wholly alfalfa does not seem to give economical results.

"This experiment shows that cut or ground alfalfa can be substituted for shorts at the same price in fattening pigs."

In another test a lot of 10 young sows were fed for 8 weeks corn meal and ground alfalfa hay 1:1, in comparison with a similar lot of 11 sows fed like proportions of ground barley and ground alfalfa hay. The average daily gain on the corn-meal ration was 0.98 lb. per head and on the barley ration 0.84 lb. "Both these lots made fine gains and at farrowing time produced large, strong litters, showing that the rations had been nearly ideal . . . for brood sows."

In a third test, 13 brood sows averaging 258 lbs. each were fed a ration of 2

lbs. corn meal and 6 lbs. of cut alfalfa hay throughout the winter. At the end of the fifth week, when the sows began to farrow, the average weight was 264 lbs. "These sows kept in fine condition, farrowing during February and March, and saved large litters in every case. They were fed a ration one-half corn or barley and one-half alfalfa while suckling pigs.

"These several experiments, including 113 animals in all, give excellent proof of the high nutritive value of alfalfa supplemented by a small corn ration."

Experiments on the rational feeding of army horses, H. VAN DE VENNE (*Rapport sur des expériences d'alimentation rationelle du cheval de troupe. Brussels: H. Lamertin, 1905; rev. in Centbl. Agr. Chem., 34 (1905), No. 12, pp. 825–829*).—The possibility of substituting for oats a commercial feed made up of 60 per cent molasses, 20 per cent corn feed, and 20 per cent linseed meal was studied with horses belonging to the military and war school at Brussels.

Judged by the weight of the animals, the author concluded that the normal ration made up of 5.5 kg. oats, 0.6 kg. bran, 3.0 kg. hay, and 0.2 kg. chopped straw was sufficient for their needs. When about half the oats was replaced with the molasses feed somewhat greater gains were made than on the normal ration. The molasses ration had no marked effect on the amount of water consumed.

The influence of crushing on the digestibility of oats, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 10 (1905), No. 51, pp. 777–779, fig. 1*).—According to the author's investigations crushing oats increases their digestibility when fed to horses. He states that they have been fed with satisfactory results for some years by the Paris Cab Company and have effected a decided saving.

Report of manager of the poultry department, W. R. GRAHAM (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 228–239, figs. 5*).—The class-room work in poultry and the general treatment of the college breeding stock are discussed, and experimental work with incubators, with poultry houses, and with different rations for fattening chickens is reported.

Many of the incubator chickens were affected with white diarrhea, and it seemed possible that incubators operated in badly ventilated rooms were the cause, though the experiments undertaken did not lead to definite conclusions. However, well-ventilated rooms which are not very moist, an even temperature for the incubators, and fresh air for the chickens from the first day of hatching are recommended, as well as healthy eggs from vigorous stock and the avoidance of sloppy foods. Scalded milk, boiled rice, and rice water are, in the author's opinion, at times excellent preventives for this trouble, which was apparently not of bacterial origin.

When different sorts of poultry houses were tested, "the use of straw over-head was effectual in keeping the houses dry. The coldest house . . . proved to be the most satisfactory in both the number of eggs produced, the fertility of the eggs, and also in the general health of the birds. . . . Grass runs at the north of the houses are not equal to runs on the south, especially in the late autumn when the wind blows in one door and out of the opposite."

The rations used for fattening chickens are described, and the results obtained with a number of rations mixed with sweet skim milk, sour skim milk, whey, and water are given, 19 lots of 12 chickens each being used and the test covering 3 weeks. A ration of equal parts corn meal, oatmeal, and shorts mixed with whey was the cheapest, a pound of gain costing 4 cts. A mixture of equal parts of ground corn, oats, and barley mixed with water was the dearest, a pound of gain costing 12.34 cts. The grain required per pound of gain was also greatest with this ration, being 10.73 lbs. The smallest amount, 2.5 lbs., was required with equal parts of shorts, corn meal, and oatmeal, with 25 per cent of beef

"Sour skim milk, i. e., milk that is thickened, is without doubt the best liquid to mix with grain rations where a uniform product is wanted, and more so where white-fleshed chickens are in demand. Sweet skim milk has not a feeding value for grown chickens equal to sour milk. Whey is a better food than is generally considered. The results appear to indicate that it aids digestion. Whey and pork scrap have not given the results expected, and . . . this combination [is not recommended]. Where pork scrap and beef scrap can be procured at reasonable cost, say 2 cts. or less per pound, they are good value, especially where a yellowish flesh is in demand. Grain mixtures only mixed with water are not economical considering this test."

Artificial incubation, E. BROWN (*Jour. Bd. Agr. [London], 12 (1905), No. 2, pp. 87–96, fig. 1, dgms. 3*).—The results of incubation experiments carried on at the Reading College Poultry Farm are summarized.

"The results of the year's operations have been eminently satisfactory, and to secure with so large a number an average of 75.82 per cent is indicative of the success attending the use of artificial methods of hatching under suitable conditions and with well-made reliable machines.

"Hens have chiefly been employed for the hatching of ducklings, and the extent of observations with incubators was too limited to make any special records."

Hints to poultry raisers, G. A. BELL (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 82, pp. 3*).—Varieties, poultry houses, feeding of hens, and the feeding of young chicks are the topics discussed in this general summary of data.

The marketing of poultry products, F. H. STONEBURN (*Connecticut Storrs Sta. Bul. 38, pp. 28, figs. 8*).—In this discussion of marketing poultry products, the author considers choice of markets, prices, methods of classifying and packing eggs, methods of killing, dressing, and shipping poultry, market conditions with reference to chickens of different ages, capons, turkeys, geese, ducks, guinea fowls, and squabs, and related questions.

The author calls attention, in discussing the utilization of by-products, to the fact that the fresh blood obtained when the chickens are killed may advantageously be fed to live poultry. "Because of the high percentage of protein it contains, it is especially valuable as food for laying and young stock. It can be most conveniently fed by mixing in the mash feed."

The losses in weight in killing and dressing 554 cocks, cockerels, hens, and pullets were recorded. On an average the weight of the birds bled and plucked was 9.4 per cent less than the live weight. With the intestines, head, and feet removed, the dressed birds weighed 25.2 per cent less than alive.

Poultry and pigeon-squab combination, M. K. BOYER (*Rel. Poultry Jour., 12 (1906), No. 12, pp. 1245–1248, figs. 5*).—On the basis of experience, the author believes that squab and poultry raising may be successfully combined. The care of breeding stock, preparation of squabs for the market, and related questions are discussed.

Breeding wood ducks, S. D. TALBOT (*Rel. Poultry Jour., 12 (1906), No. 11, p. 1128*).—On the basis of experience the author states that wood ducks can be successfully raised in captivity.

A yard having bushes as shelter should be provided and inclosed with netting. In short, an attempt should be made to approximate their natural surroundings as closely as practicable. A house is not needed, but some shelter is useful in winter. The birds do not lay until they are two years old. The yards should be covered with wire netting, or if this is not convenient the wing may be unjointed at the first joint to prevent flight.

Raising guinea fowls, JENNIE O'CONNER (*Texas Farm and Ranch, 25 (1906), No. 5, p. 14*).—In a discussion of the feeding and care of guinea fowls the

author states that mites and lice are more dangerous for these birds than for other classes of poultry and that precautions should be taken to keep them free from such pests.

DAIRY FARMING—DAIRYING—AGROTECHNY.

Gluten and cotton-seed meal with silage, hay, and stover for dairy cows, A. M. SOULE and J. R. FAIN (*Virginia Sta. Bul. 156, pp. 30, figs. 16*).—The author reports a feeding experiment and discusses at some length the feeding of dairy cows with special reference to Virginia conditions.

Four lots of 6 cows each were fed experimentally for 120 days. The cows in lot 1 consumed on an average 8.18 lbs. of gluten and corn-and-cob meal, 5.73 lbs. of silage, and 6.57 lbs. of hay; the cows in lot 2, 9.01 lbs. of cotton-seed and corn-and-cob meal, 5.71 lbs. of silage, and 6.45 lbs. of hay; the cows in lot 3, 8.82 lbs. gluten and corn-and-cob meal, 5.76 lbs. silage, and 2.61 lbs. of stover; and the cows in lot 4, 9.85 lbs. of cotton-seed and corn-and-cob meal, 5.52 lbs. of silage, and 3.35 lbs. of stover. Gluten meal was therefore contrasted with cotton-seed meal and hay with stover.

Combining the groups with reference to the hay and stover, it was found that the lowest amount of food consumed per gallon of milk and pound of butter produced was shown by the lots fed hay, and that the net cost of a gallon of milk and a pound of butter was less with the hay ration than with the stover ration. The difference, however, was not marked, indicating clearly, according to the author, that a good quality of corn stover can often be fed with practically as good results as timothy hay.

Combining the lots with reference to the gluten meal and cotton-seed meal the results showed a slight difference in favor of the cotton-seed meal. The total amount of food consumed, as well as the net cost per pound of butter and gallon of milk, was, however, practically the same in each case. At the prices quoted, however, it was considered that the cotton-seed meal should be given the preference.

"The experiment also seems to indicate quite clearly that foodstuffs may be properly compared on the basis of the digestible protein they contain, which is in line with a number of feeding experiments previously made, and would seem to be a safe conclusion to draw."

Dried beet pulp as a substitute for corn silage; dried beet pulp v. dried molasses beet pulp; dried molasses beet pulp v. hominy meal, G. A. BILLINGS (*New Jersey Stas. Bul. 189, pp. 24, pl. 1*).—A comparative test of dried beet pulp and corn silage was made with two lots of two cows each during 2 periods of 15 days each.

The beet-pulp ration consisted of 9 lbs. of pulp, 10 lbs. of mixed hay, 10.5 lbs. of mixed feed, and the silage ration of 45 lbs. of silage, 5 lbs. of mixed hay and the same amount of mixed feed. The pulp ration produced 10.2 per cent more milk and 9.7 per cent more butter than the silage ration, but the cost was greater. On the silage ration the cost of 100 lbs. of milk was 2.8 cts. less and the cost of 1 lb of butter 0.61 ct. less than when the pulp ration was fed.

In the second experiment of a similar nature a comparison was made of dried beet pulp and dried molasses beet pulp, and in the third test dried molasses beet pulp was compared with hominy meal. The last two experiments presented here in abstract form have been noted from another source (E. S. R., 17, p. 394).

Alfalfa hay v. purchased feeds, G. A. BILLINGS (*New Jersey Stas. Bul. 190, pp. 19-31, pl. 1*).—A feeding experiment was made with 8 cows during 60 days for the purpose of securing additional data on the value of home-grown alfalfa hay. Previous comparisons of home-grown and purchased feeds were reported

in Bulletins 148, 161, and 174 of the station (E. S. R., 13, p. 176; 14, p. 604; 16, p. 298).

The alfalfa ration consisted of 14 lbs. alfalfa hay, 35 lbs. corn silage, and 2½ lbs. cotton-seed meal. The purchased feed ration consisted of 40 lbs. corn silage, 7 lbs. cornstalks, 4½ lbs. wheat bran, 4½ lbs. dried brewers' grains, and 2 lbs. cotton-seed meal. The average daily yield per cow on the alfalfa ration was 26.3 lbs. of milk, containing 4 per cent of fat, and on the feed ration 27.3 lbs. of milk, containing 4.15 per cent of fat. With alfalfa hay at $6 per ton (the estimated cost of production) the cost of producing 100 lbs. of milk from this ration was 47.6 cts., while the cost of milk production on the feed ration was 71.8 cts. per 100 lbs. of milk.

The cost of producing 1 lb. of butter on the two rations was respectively 10.17 and 14.86 cts. Comparing the results of the present with the earlier experiments it was found that the saving in cost of production by home-grown feeds over purchased feeds was 22.4 per cent for milk and 20.2 per cent for butter, indicating the great advantage of growing protein feeds.

Forage and soiling experiments, 1904, G. C. Watson and T. I. Mairs (*Pennsylvania Sta. Bul. 75, pp. 12*).—The forage crops grown during the season were as follows: Flat peas, peas and oats, peas and barley, clover, cowpeas and sorghum, and cowpeas. Notes are given on the culture of each of these crops and the yields are reported in tabular form.

The crops were fed to 5 cows and data are given showing the production by each. Similar tests were made in 1902 and 1903 (E. S. R., 15, p. 998; 17, p. 285). Of the crops grown during the 3 years, sorghum and cowpeas produced the largest yield of green substance per acre and alfalfa the greatest weight of air-dry substance. Both crops are considered very satisfactory as green forage. Corn grown as a single crop ranked second in the production of air-dry matter. Field peas and oats are also considered very satisfactory field crops. Flat peas and rape are not recommended. Cowpeas are considered preferable to soy beans.

Feeding experiments with milch cows, J. Hansen (*Landw. Jahrb., 35 (1906), No. 1–2, pp. 125–158*).—Several feeding stuffs were compared by feeding in successive periods in experiments with 6 cows, lasting in all 142 days.

The feeding stuffs used were wheat bran, cocoanut cake, "Maizena," fat-free palm-nut meal, and palm-nut cake. When fed in quantities having the same amount of digestible nutrients, the different feeding stuffs exerted, according to the conclusions reached by the author, a very unequal influence upon the yield of milk. Independent of the amount of nutrients contained, the feeding stuffs were considered as having a specific influence on milk production, both as regards the yield of milk and the fat content of the milk.

As compared with wheat bran "Maizena" increased yield of milk, but decreased the percentage of fat. The cocoanut cake and the residues from the manufacture of palm oil produced practically the same amount of milk as the wheat bran, but increased to a marked extent the fat content of the milk. Compared on the basis of digestible nutrients cocoanut cake produced no better results than the residues from palm oil manufacture. The palm-nut cake obtained by pressure had the same influence as the palm-nut meal obtained by extraction.

Experiments on feeding dairy cows, C. B. Jones (*Abs. in Dairy, 18 (1906), No. 206, p. 39*).—The feeding experiments included 20 cows and covered in all a period of 48 weeks. Some of the general conclusions reached are in substance as follows:

A heavy grain ration of 12 lbs. or more may cause an increase in the yield of milk but not always with profit. The limit beyond which it is unprofitable to increase the allowance of concentrated feeds was not ascertained, but it may be

regarded as certain that 12 lbs. per 1,000 lbs. live weight is, on the average, excessive. It is considered doubtful if an increase in the amount of grain has any appreciable influence upon the quality of the milk.

The morning milk of an average lot of cows, even when well fed, may frequently be under the standard in butter fat during the earlier part of the lactation period and an increased amount of grain causes but little improvement in this respect. The gain in live weight of cows fed a heavy grain ration was much greater toward the end of the lactation period. The results, therefore, are in favor of the practice of feeding dairy cows grain rations largely in proportion to the amount of milk produced.

The second series of experiments reported related to the effect upon the quantity and quality of milk of equal and unequal intervals between milkings. One lot of 5 cows was milked at 6 a. m. and 4 p. m. and another lot at 6 a. m. and 6 p. m. When the intervals were equal the morning milk contained on an average 4 per cent of fat and when unequal 3.6 per cent, confirming results obtained elsewhere.

Contribution to the manner of conducting practical feeding experiments with milch cows, A. OSTERMAYER (*Österr. Molk. Ztg., 13 (1906), Nos. 2, pp. 15–17; 3, pp. 29, 30*).—This article summarizes briefly the results of 15 feeding experiments in different parts of Moravia. Each test lasted 120 days divided into 5 periods. During the second and fourth periods the value of sesame cake was tested. In all 93 cows were used in the trials. The results were favorable to the feeding of sesame cake, but are discussed mainly with a view to showing the value of conducting practical tests of this kind.

On the influence of feeding stuffs on milk and milk products, A. BURR (*Molk. Ztg., 19 (1905), Nos. 40, pp. 1025, 1026; 45, pp. 1147, 1148; 49, pp. 1243, 1244; 50, pp. 1267, 1268; 51, pp. 1295–1297*).—This summarizes considerable information on the effects of feeding cows potatoes, potato vines, potato pulp, the residue from the manufacture of alcohol from potatoes, root crops, beet pulp, molasses, artichokes, various leguminous crops, and other feeding stuffs.

Dairy cow demonstration of the Louisiana Purchase Exposition, E. H. FARRINGTON (*Fort Atkinson, Wis.: W. D. Hoard Co., 1905, pp. 64, figs. 25*).—This report contains the supplementary regulations governing the tests, the general plan on which the demonstration was conducted, analyses of the feeding stuffs used, and the daily records of the herds, which consisted of 5 Brown Swiss cows, 15 Holstein cows, 25 Jersey cows, and 29 Shorthorn cows. The test lasted 120 days. The following table summarizes some of the data obtained:

Record of the best, poorest, and average cow in each herd.

	Daily yield of milk.	Fat content of milk.	Daily yield of fat.	Daily yield of butter.	Daily yield of solids-not-fat.	Food cost of milk per quart.	Food cost of butter per pound.
Brown Swiss:	*Lbs.*	*P. ct.*	*Lbs.*	*Lbs.*	*Lbs.*	*Cts.*	*Cts.*
Best cow	51.0	3.40	1.748	2.042	4.363	1.09	13.6
Poorest cow	38.5	3.80	1.477	1.731	3.585	1.39	15.5
Average cow	44.2	3.62	1.596	1.870	3.919	1.24	14.7
Holstein:							
Best cow	67.5	3.50	2.355	2.753	5.171	.90	11.0
Poorest cow	47.1	3.20	1.507	1.756	3.614	1.22	16.4
Average cow	53.4	3.43	1.832	2.120	4.239	1.07	13.5
Jersey:							
Best cow	48.4	4.80	2.334	2.750	4.357	1.10	9.7
Poorest cow	38.8	4.10	1.615	1.898	3.441	1.30	13.2
Average cow	41.5	4.70	1.936	2.280	3.634	1.16	10.5
Shorthorn:							
Best cow	43.4	4.00	1.737	2.037	3.720	1.09	11.7
Poorest cow	21.4	3.90	.843	.988	1.902	2.15	23.4
Average cow	34.6	3.80	1.277	1.495	2.980	1.32	15.3

Official tests of dairy cows, 1904–5, F. W. Woll (*Wisconsin Sta. Bul. 131, pp. 46, figs. 20*).—During the year 864 tests were made of 356 cows of which 245 were Holstein, 93 Guernsey, 9 Jersey, 7 grades, 1 Shorthorn, and 1 Red Poll. The tests are reported in detail and illustrations are given of many of the cows. The rules regarding the conduct of the dairy tests are appended.

Report of the professor of dairy husbandry, H. H. Dean (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 106–133*).—Brief notes are given on the work of the dairy department during the year, and experiments in butter making, cheese making, and feeding cows are reported.

Experiments in butter making (pp. 107–115).—In 5 experiments a comparison was made of churning pasteurized sweet cream directly after adding 20 to 25 per cent of culture with similar cream ripened in the usual way after adding the same amount of culture. The results of the present experiments as well as those of the previous year (E. S. R., 17, p. 178) showed that a butter of better keeping quality was produced from the sweet cream than from the ripened cream, although the yield was not quite so great.

Experiments were conducted to determine the relative value of churning sweet cream without any culture and with the addition of 10, 20, and 30 per cent of culture. The sweet cream lots churned in less time and at lower temperature than the other lots. The loss of fat in the buttermilk decreased as the amounts of culture added increased. The slight difference in the quality of the butter from the different lots was in favor of the addition of 30 per cent of culture.

Pasteurization of milk was compared with pasteurization of cream. The results showed very little difference in the quality of the butter. As the pasteurization of cream and skim milk separately is considered more convenient, this method is recommended for creameries.

Ripe cream was pasteurized at temperatures of 130, 140, 160, and 180° F. The pasteurization made little or no difference in the acidity of the cream nor in the time required for churning. The greatest loss of fat was from cream heated to 140° and the highest yield of butter from cream pasteurized at 180°. There was apparently not much difference in the quality of the butter from the 4 lots. The author, therefore, recommends a temperature of 180 to 185° for the pasteurization of ripe cream, but considers it better, however, to pasteurize the cream when sweet.

In continuation of experiments with butter preservatives, previously noted (E. S. R., 17, p. 182), tests were made of salt, borax, boric acid, mixtures of borax and boric acid, mixtures of borax, boric acid and common salt, mixtures of a commercial preservative and common salt, and 3 commercial preservatives. The results are tabulated and lead to conclusions similar to those previously quoted. The author is not prepared at present to recommend preservatives other than common salt for butter to be used for home consumption, but considers it an advantage to use 0.25 per cent boron preservatives in unsalted butter for export.

Five experiments were made in regard to increasing the percentage of water in butter. The water content of the butter was not increased by having a stream of cold water playing upon the butter while it was being worked. In only 2 instances was there an increase in the water content as the result of washing and working at the same time.

A comparison was made of 2 combined churns, the results being practically the same for both.

Experiments in cheese making (pp. 115–126).—Rennet was compared with

pepsin for coagulating milk in cheese making. The yield of cheese was slightly greater and the quality somewhat better when rennet was used. Pepsin is not recommended as a substitute for standard rennet inasmuch as it is much more difficult to prepare for use and does not keep well when dissolved.

In continuation of experiments during the 2 previous years comparisons were made of 3½ and 6¾ oz. of rennet per 1,000 lbs. of milk. The results showed very little difference in the yield of marketable cheese or in the quality as a result of using double the ordinary amount of rennet.

Nine tests were made to compare milling curds crosswise and lengthwise, the results showing little or no difference in the two methods. Curds milled length wise lost about 0.5 per cent more in weight.

Experiments were again made with cheese containing normal and excessive amounts of moisture. The results of the experiments are considered as indicating that the average percentages of moisture, 45 at dipping and 34 in the green cheese, may be increased without injuring the quality of the cheese if ripened in cold storage at about 40° F. It is stated that a rapid method of ascertaining approximately the amount of moisture in curd at dipping has been discovered, but that experiments will be conducted for another season before the results are reported.

In 18 experiments curds were heated at temperatures ranging from 101 to 110° as compared with the temperature of 98 to 100° ordinarily employed. Cooking at temperatures above 100° tended to check the development of acid, decreased the yield of cheese, and did not improve the quality.

In 16 experiments the effect of different degrees of acidity of curds at the time of salting was studied. The results showed that the greater the amount of acidity at the time of salting the less was the yield of cheese. The quality of the cheese, however, was apparently more satisfactory when the acidity was comparatively high, less than 1 per cent showing a tendency toward a poorer quality of cheese.

In 16 experiments further comparative tests were made of ripening cheese at different temperatures. The conclusion is drawn from the results obtained during the 3 years that the lower the uniform temperature at which cheese can be ripened economically, the better will be the quality of the cheese, and the less the loss in weight during ripening.

Further experiments were also made on moving cheese from the ordinary curing room to cold storage at the end of 1 week. Very little difference was observed in the quality of the cheese whether placed directly in cold storage or removed to cold storage at the end of 1 week. The conclusion is therefore drawn that cheese may be moved once a week to cold storage without interfering with the quality of the cheese, although the shrinkage will be greater.

Comparative tests for the third year were made on placing cheese on shelves and boxing directly from the press. The results agree with the previous experiments and indicate, according to the author, that it is quite practicable to put cheese into a clean, dry box and place in cold storage at 40°. The development of mold is considered an objection to the method. Boxing directly from the press reduces the loss from shrinkage.

Experiments in paraffining cheese showed that this method decreased the loss in weight but also lowered the quality of the cheese. It is considered doubtful if paraffining cheese is advisable for the ordinary cheese maker.

Experiments in dairy stable (pp. 126–131).—In tests with 4 calves a comparison was made of bran, oats, and oil cake with bran and Blatchford calf meal with and without skim milk. The conclusion is drawn from the results of

the experiments that thrifty calves for the dairy may be reared on skim milk, wheat bran, ground oats, and a little oil cake or flaxseed meal, after getting a start for about 3 weeks on whole milk.

Comparative tests were made of daily rations of 4, 8, and 12 lbs. of a grain mixture consisting of bran 4 parts, oats 3 parts, and oil cake 1 part. The fat content of the milk was practically the same in each instance. The highest daily yield per cow was from the largest amount of grain, but the average cost per 100 lbs. of milk was 68.1 cts. as compared with 51.4 and 45.4 cts. for the rations containing 8 and 4 lbs. of grain, respectively. It is believed that about 8 lbs. per day is the proper amount for average cows.

A test was made of a commercial feeding stuff designated sugar and flaxseed meal. The addition of 1½ lbs. of this material to the regular ration did not increase the yield of milk.

Dairy herd record (pp. 131–133).—Records are given of a dairy herd of 24 cows for 1 year. The yield of individual cows ranged from 10,249 lbs. of milk to 3,310 lbs. and the profit on milk over cost of food from $117.78 to $34.84.

The milk scales, the milk sheet, and the Babcock test for the farmers of South Carolina, B. H. RAWL (*South Carolina Sta. Bul. 95, pp. 17, figs. 12*).—This bulletin describes and illustrates methods of obtaining and keeping dairy herd records.

The chemical composition of colostrum with especial reference to the proteids, E. WINTERSTEIN and E. STRICKLER (*Ztschr. Physiol. Chem., 47 (1906), No. 1, pp. 58–82*).—Methods of analysis are described and references are made to the more important contributions to the literature of this subject.

From the proteids of colostrum coagulated by heat the authors obtained by hydrolysis, alanin, aminovalerianic acid, leucin, pyrrolidin-carboxylic acid, serin, phenylalanin, tyrosin, aspartic acid, glutaminic acid, cystin, and other unidentified amino acids, arginin, histidin, lysin, tryptophan, and ammonia. These proteid substances contain, in addition, one or more carbohydrate radicals.

Colostrum was found to contain the following constituents: Casein, albumin, globulin, fat, free-fatty acids, lecithin, cholesterin, glycerol-phosphoric acid, milk sugar, and urea. The following were not found: Tyrosin, cholin, nuclein, and hexon bases. Aside from milk sugar, no other optically active carbohydrate capable of reducing Fehling's solution was found.

Taint in milk due to contamination by copper, J. GOLDING and E. FEILMANN (*Jour. Soc. Chem. Indus., 24 (1905), No. 24, pp. 1285, 1286, fig. 1*).—A bad flavor in milk was traced to the use of a cooler from which much of the tin was worn off, exposing the copper.

This suggested an investigation to determine the action of milk on copper in which it was found that milk is capable of dissolving from 1 to over 100 parts of copper per million of milk. The quantity of copper passing into solution was much greater when the milk was exposed to the air. The taint originally observed in milk was reproduced experimentally in milk exposed to the influence of copper. A peculiar flavor developed in 16 to 18 hours after such contamination.

A bacteriological study was made of milk in which the characteristic flavor was present. The presence of copper was found especially unfavorable to the development of lactic-acid bacteria, and therefore tended to delay the souring of the milk. When, however, milk was heavily inoculated with lactic-acid bacteria, the milk soured without the development of the peculiar flavor mentioned. The origin of this flavor is attributed in part to the development of bacteria as influenced by the presence of copper and in part to a direct influence of the copper.

Fat content of separator slime, P. GORDAN (*Milchw. Zentbl., 1 (1905), No. 11, p. 499*).—A microscopical examination of separator slime showed the presence of large numbers of fat globules. Determinations by the Gerber method showed the presence of 10 to 19 gm. of fat per kilogram of separator slime.

Milk and butter preservatives, R. HARCOURT (*Ann. Rpt. Ontario Agr. Col. and Expt. Farm, 31 (1905), pp. 69, 70*).—In 29 samples of commercial preservatives examined, sodium chlorid and sodium bicarbonate were almost invariably present in large quantities, the amount of common salt being often over 20 per cent. The boron compounds regularly present were not determined.

Investigations on the preservation of milk samples, M. SIEGFELD (*Milchw. Zentbl., 1 (1905), No. 11, pp. 488–493*).—Comparative tests were made of formalin and potassium bichromate. The results were interpreted as showing that formalin is the most satisfactory preservative for this purpose. The author recommends the addition of only 2 to 3 drops of the commercial solution diluted one-half with water to 100 cc. of milk.

The adulteration of butter, C. SIMMONDS (*Nature [London], 73 (1906), No. 1898, pp. 466–468*).—This is a concise presentation of modern methods employed in the adulteration of butter and of the means adopted or suggested for the prevention of this fraud.

Some of the factors that control the water content of butter, F. T. SHUTT, C. F. WHITLEY, and A. T. CHARRON (*Canada Dept. Agr., Dairy Comr. Branch Bul. 8, pp. 10*).—The factors studied experimentally were the temperature of churning, temperature of wash water, size of granules when churning was stopped, length of time between salting and final working, and the effects of varying amounts of salt.

From the comparison of high and low churning temperatures and high and low temperatures of wash water it was concluded that the higher the churning temperature, within reasonable limits, the higher the water content of the butter; that the higher water content, due to a higher churning temperature, may be reduced to a certain extent though not to a safe amount by a low temperature wash water; and that a high churning temperature causes a greater loss of fat in the buttermilk.

Butter was churned to the size of clover seed, corn grains, and walnuts, the results showing that the larger the granules the higher the water content of the butter. Butter worked 24 hours after salting contained 11.78 per cent of water as compared with 13.42 per cent in butter worked 2 hours after salting. Butter salted at once and worked after 24 hours contained 11.91 per cent of water, while butter worked slightly immediately after churning, and salted and worked after 24 hours contained 12.51 per cent of water. These results show, therefore, that the length of time between salting and working is an important factor in reducing the water content of butter. Allowing butter to drip for 10, 15, or 30 minutes did not materially affect the water content.

Butter salted at the rate of ½ oz. per pound and worked 2 hours after salting contains slightly more water than butter salted at the rate of 1 oz. per pound and worked after the same interval. There was practically no difference, however, when the 2 lots were worked 24 hours after salting. Butter not salted contained slightly more water than butter salted at the rate of 1 oz. per pound. A slight working of butter before salting did not appear to affect materially the water content of the butter. The results on the whole show that there is a very distinct relation between the process of manufacture and the water content of the butter.

The constituents of Emmenthal cheese, E. WINTERSTEIN and W. BISSEGGER (*Ztschr. Physiol. Chem., 47 (1906), No. 1, pp. 28–57*).—Reference is made to previous investigations on the nitrogenous constituents of Emmenthal cheese

(E. S. R., 16, p. 196), methods of quantitative analysis used are described in detail and the results obtained are reported. The following table shows the nitrogenous constituents calculated to fat, ash, and water-free substance:

Nitrogenous constituents in Emmenthal cheese.

	Age of cheese.	
	8 months.	11 months.
	Per cent.	*Per cent.*
Total nitrogen	14.48	14.73
Total proteid nitrogen	11.57	11.57
Nitrogen in coagulable proteids	.45	.28
Nitrogen in peptones	1.04	.82
Nitrogen in bases[a]	1.13	1.07
Nitrogen in lysin	.56	.47
Nitrogen in ammonia	.06	.48
Nitrogen in amino acids	1.50	1.74
Nitrogen in purin bases	.03	.03
Nitrogen in water extract	4.32	4.28
Nitrogen in phosphotungstic precipitate from water extract		2.25
Water soluble organic material	22.76	26.02

[a] Nitrogen in the precipitate by phosphotungstic acid including, in addition to the bases, lysin, tetramothylendiamin, pentamethylendiamin, other decomposition products, and cholin

On the presence of acid and rennet producing bacteria in ripening cheese, C. Gorini (*Milchw. Zentbl., 1 (1905), No. 11, pp. 494–498*).—Notes are given on the different types of bacteria capable of producing acid and rennet in cheese. These include different forms of cocci and a spore-forming bacillus designated *Bacillus acidificans presamigenes casei.* Three groups of milk bacteria are recognized—lactic-acid bacteria, which produce acid without peptonizing the casein; bacteria which peptonize casein without producing acid, and bacteria which decompose both the milk sugar and the casein.

On the classification of the bacteria of milk with special reference to the acid and rennet producing bacteria, A. Rodella (*Milchw. Zentbl., 2 (1906), No. 1, pp. 8–12*).—This is a discussion of the classification of milk bacteria.

The causes of "blowing" in tins of condensed milk, G. H. Pethybridge (*Econ. Proc. Roy. Dublin Soc., 1 (1906), No. 7, pp. 306–320*).—The author investigated the occasional occurrence of spoiled cans of condensed milk in the product of one factory, and found the cause to be yeasts which were not introduced into the milk with the cane sugar used and which were not inhibited in their activity by increasing concentration of the cane sugar.

The source of the yeasts was apparently the original milk supply. As the destruction of the yeasts by heat during the manufacture of condensed milk was not practicable, more careful attention was paid to the condition of the milk supply and a considerable improvement followed the rejection of dirty milk.

Annual report on the investigations and progress of the manufacture of sugar, J. Bock (*Jahresber. Zuckerfabrik. [Stammer], 44 (1904), pp. X+307, figs. 24*).—Chapter 1 of this review of the literature of sugar making for 1904 deals with the agricultural features of the industry, chapter 2 with the technology of sugar making, and chapter 3 with chemical methods and investigations. Two concluding chapters contain a list of patents relating to the sugar industry and statistical matter.

The manufacture of cane sirup, B. B. Ross (*Alabama College Sta. Bul. 133, pp. 143–168, figs. 2*).—The author discusses the different steps in the manufacture of cane sirup, making numerous suggestions for the improvement of methods in common use in the State. Some experimental work is also reported.

Extraction tests showed that in most cases the 2-roller and 3-roller mills

removed from 55 to 60 per cent of the juice. The highest extraction, approximately 75 per cent, was secured with a 5-roller mill. In an earlier bulletin of the station a form of sulphuring apparatus was described (E. S. R., 7, p. 719). In the present bulletin a still simpler form improvised from a large sirup barrel is described. The station has also found it possible to employ liquified sulphurous acid as a clarifying agent. While good results may be obtained by the use of sulphur fumes alone it was found that better results could be obtained by the use of lime in addition.

Instead of either of these methods, however, the bisulphite of lime may be used in the proportion of 1:200, although the sirup is not usually so bright as when the juice is treated with sulphur fumes. It is stated that in many cases the acid phosphate of lime was used as a clarifying agent with excellent results. Fairly good results were obtained by the use of sand filters for the removal of suspended matter. The use of cotton batting as a filter for the hot sirup was tested, favorable results being secured. Numerous other features connected with the manufacture of cane sirup were also studied experimentally.

Experiments with fermentation of fruit juices, G. KNUDSEN (*Tidsskr. Norske Landbr., 12 (1905), No. 5, pp. 222–230*).—Experiments with 10 kinds of pure-culture yeast of different origin in making wine from currant, raspberry, and blueberry juice are reported.—F. W. WOLL.

Chemical processes in wine making, K. WINDISCH (*Die chemischen Vorgänge beim Werden des Weines. Plieningen: Friedrich Find, 1905, pp. 122*).—This deals with the different kinds of sugar and acids in grape juice and cider, and the chemical changes taking place in these products during fermentation and storage.

The spinning and twisting of long vegetable fibers, H. R. CARTER (*London: Charles Griffin & Co., Ltd.; Philadelphia: J. B. Lippincott Co., 1904, pp. XVI+360, pls. 10, figs. 151*).—This book is a practical manual of the most modern methods as applied to the hackling, carding, preparing, spinning, and twisting of flax, hemp, jute, tow, and ramie.

VETERINARY MEDICINE.

Division of veterinary science, J. A. GILRUTH (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 152–227, figs. 3*).—A detailed report is made of the veterinary staff of New Zealand, the work performed in meat inspection in connection with abattoirs and export slaughter houses, dairy inspection, and various investigations relating to animal diseases.

Contagious mammitis has spread without much control since the author's previous report. It is recommended that compulsory notification be required for this disease together with the registration of all dairy herds, their periodic inspection, and the sterilization and pasteurization of all milk at creameries. The present distribution of the disease is briefly outlined. In treating mammitis the author recommends injections of boracic acid. Notes are also given on the present occurrence of blackleg in New Zealand. By means of preventive vaccination the mortality of this disease has been reduced to the extent of 75 per cent.

A brief account is also given of anthrax, hepatic cirrhosis, tuberculosis, abortion, sterility, contagious pleuro-pneumonia in lambs, a disease resembling braxy, cystic kidney in pigs, cancer of the eyelid and liver in fowls, hydatids in sheep, tetanus, various forms of cancer in calves, and pasteurellosis in calves and pigs. A study of the last-named disease showed that the cause was a micro-organism belonging to the Pasteurella group, which produces a hemorrhagic septicemia. The organism appears to gain entrance through the navel

of new-born calves and other animals. Subcutaneous inoculation of the micro-organism even in large doses in calves produced only local inflammatory swellings with no constitutional disturbance. Pigs fed and inoculated subcutaneously with the cultures failed to develop any pronounced symptoms of the disease, while intravenous inoculation caused acute constitutional symptoms with high temperature.

Reports of inspectors of stock for the year ended March 31, 1905, E. CLIFTON ET AL. (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 92–126*).—Notes are given on the number of domestic animals in various inspection districts of New Zealand and also on the state of the health of animals, with particular reference to the more important diseases, especially contagious abortion, mammitis, sheep scab, tuberculosis, etc.

Diseases of the bone and phosphates in the feed, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 9 (1905), No. 23, pp. 726, 727*).—Attention is called to the variation in the content of phosphoric acid in various food materials and to the relationship between weakness and disease of the bone and the relative scarcity of phosphoric acid in the food. In general the results of various investigators indicate that the weak condition of the bones of domesticated animals may frequently be attributed to a lack of phosphoric acid in their food.

Comparative study of different forms of tuberculosis, S. ARLOING (*Jour. Méd. Vét. et Zootech., 56 (1905), Dec., pp. 705–721*).—This article is a report presented by the author at the recent International Congress of Tuberculosis in Paris, and the report is accompanied by short statements by Kossel and Ravenel.

The author, on the basis of his investigations, has been led to the conclusion that the differences between various races of tubercle bacilli coming from different animals and man are slight as compared with their points of resemblance. This variation is, therefore, looked upon as a mere biological function of the tubercle bacillus. The various types of tubercle bacilli recognized by different bacteriologists are considered as varieties of the same species. As an argument in favor of this position, the author states that all varieties of tubercle bacilli are agglutinated by serum from tuberculous animals or human beings.

It is concluded, therefore, that human and bovine tuberculosis are of the same nature and intertransmissible. It is necessary to protect human beings from infection through tuberculous meat and milk, and also to protect animals from human tuberculous patients. Kossel, in his report, calls attention to the differences between the human and bovine type of tubercle bacillus and maintains that bovine tuberculosis is due exclusively to the bovine form of the bacillus. Pigs are susceptible to both forms, and man may become infected by tuberculous meat, but more frequently by the milk of tuberculous cows. Ravenel states that the bovine tubercle bacillus may gain entrance to man and cause tuberculous lesions. In general, the human bacillus is much less virulent than the bovine form.

Studies on tuberculosis, II, A. KÖPPEN (*Ztschr. Hyg. u. Infectionskrank., 52 (1905), No. 1, pp. 111–128*).—The literature relating to the various toxins obtained from the tubercle bacillus is briefly reviewed in connection with a bibliography. The peculiar growth of tubercle bacilli on bouillon is described and is attributed to the fact that the bacteria acquire an abundance of nutriment for their rapid growth, and, therefore, the layer of the organisms shows folds when it reaches the sides of the test tubes.

A struggle with tuberculosis in domestic animals, E. UJHELYI (*Jour. Compar. Path. and Ther., 18 (1905), No. 4, pp. 299–311*).—In Hungary, tuberculosis is said to be comparatively rare in horses, sheep, and hogs.

Statistics based on slaughter findings in 1902 showed that the number of tuberculous hogs was about 2.2 per cent. Among cattle, however, the disease prevails extensively. The conditions in Hungary seem to make it desirable to apply Bang's method in the eradication of the disease, and satisfactory results have been obtained from the use of this method on a number of estates. Statistics are given showing the distribution of the disease on these estates.

Von Behring's method of immunization of young cattle against tuberculosis, C. Guérin (*Presse Méd.* [*Paris*], *1906, No. 2, pp. 13, 14*).—The author reviews experiments thus far carried out with von Behring's method of vaccination by various investigators, including Schlegel, Eber, Lorenz, Vallée, Klimmer, Römer, Ruppel, Pearson, Arloing, et al. It appears from a comparison of the results obtained by these different investigators that von Behring's method is not dangerous to young cattle and that an effective immunity is thereby brought about. This immunity has been tested by subjecting the animal to exposure much more severe than would ever occur under natural conditions.

The properties of local toxins of the tubercle bacillus, P. Armand-Delille and Huet (*Compt. Rend. Soc. Biol.* [*Paris*], *59* (*1905*), *No. 37, pp. 656–658*).—A study of local toxins produced by the tubercle bacillus indicated that such toxins in rabbits and guinea pigs did not produce an elevation of temperature greater that 0.1 to 0.5° C. Such toxins inoculated into newborn animals also failed to produce a greater elevation of temperature.

Acid-resisting properties of fatty acids in tubercle bacilli, J. Camus and P. Pagniez (*Compt. Rend. Soc. Biol.* [*Paris*], *59* (*1905*), *No. 38, pp. 701–704*).—The authors made extensive experiments in testing the effect upon tubercle bacilli of the removal of their content of fatty acids. It was found that tubercle bacilli thus treated lost the power of resisting acids.

Experimental transmission of tuberculosis to anthropoid apes, von Dungern (*München. Med. Wchnschr.*, *53* (*1906*), *No. 1, pp. 4–7*).—A brief review is presented of the literature relating to this subject.

A number of gibbons were captured and inoculated with tubercle bacilli of human and bovine origin in doses of 0.01 gm. subcutaneously. Among the apes used in the experiment, five inoculated with bovine bacilli died within 35 to 65 days and three which received human tubercle bacilli died within 37 to 63 days. No difference whatever was observed in the action of the bovine and human tubercle bacilli. Comparative feeding experiments with gibbons also failed to show any difference between the two kinds of tubercle bacilli, since cases of generalized tuberculosis developed after feeding on either kind of the bacillus.

Tuberculous spondylitis in cows, O. Stenström (*Ztschr. Tiermed.*, *10* (*1906*), *No. 1–2, pp. 133–137, figs. 3*).—Recently several cases have been reported of this form of tuberculosis in cattle. The author describes the symptoms as observed in a few instances together with notes on the pathological anatomy.

Milk fever, its causes, symptoms, and successful treatment, J. Spencer (*Virginia Sta. Bul. 158, pp. 67–79, figs. 2*).—The author discusses briefly the symptoms, causes, and treatment of this disease.

The most effective treatment thus far discovered consists in pumping atmospheric air into the udder until this organ is tightly distended. This method has been successfully used at the Virginia Station, and a suitable apparatus for this purpose is described and illustrated. Detailed clinical notes are given on 4 cases, in 3 of which a complete recovery took place, while in the fourth case the treatment was not begun until the disease had progressed too far.

In order to prevent the development of milk fever, the author recommends that dairy cows should be compelled to take considerable exercise immediately

before calving, and that purgatives be given—for example, Epsom salts in doses of 1½ lbs. Attention is also called to the desirability of using antiseptic precautions in pumping the air into the udder, since otherwise an infection may take place and lead to serious inflammation.

Parturient paresis, puerperal septicemia, and paralysis after parturition, E. HESS (*Schweiz. Arch. Tierheilk., 47 (1905), No. 6, pp. 277–304*).—The symptoms of numerous cases of these diseases are given, together with clinical notes, and an account of the line of treatment adopted by the author.

In several instances transition stages were noted between the three diseases so that all three appeared to be quite closely related. The author discusses the etiology of these diseases in some detail, as based on a study of the symptoms and pathological anatomy. As is generally known, some veterinarians recommend that in order to prevent the occurrence of parturient paresis, cows should be milked during the last 8 or 10 days before parturition. Similar results are obtained from bloodletting and from the administration of laxatives. All three of the diseases may be successfully combated by the use of air or oxygen pumped into the udder until this organ is tensely distended. Puerpural septicemia, however, may require in addition to the oxygen treatment a thorough irrigation of the reproductive organs with antiseptics.

The author suggests the desirability of determining the volume and weight of the udder of cows affected with parturient paresis before and after treatment, also the amount of blood forced out of the udder by the oxygen treatment, and the variations in the abdominal blood pressure in cows before and after parturition.

The treatment of appearance of blood or hemoglobin in the milk, K. MEUCH (*Berlin. Tierärztl. Wchnschr., 1906, No. 1, p. 4*).—In two instances the author had complete success in such cases after other remedies had failed by the use of air infusion. The air pressure produced in the udder seemed to have the effect of closing the ruptured blood vessels from which the blood escaped, and thus prevented the further admixture of blood in the milk.

Infectious vaginal catarrh of cattle, THOMS (*Monatsh. Prakt. Tierheilk., 17 (1906), No. 5–6, pp. 193–211, pls. 2, fig. 1*).—The literature of this subject is critically reviewed. It appears that cattle of all ages are susceptible to infec tious vaginal catarrh. The characteristic discharge of the disease always contains numerous diplococci and streptococci. The mucous membrane of the vagina exhibits tubercles within 4 or 5 days after the appearance of the disease. These follicular enlargements gradually decrease in size after the active infection has been controlled. It appears, therefore, that a cure may be effected before the tubercles disappear.

Sterility in milch cows, its cause and treatment, ALBRECHTSEN (*Samvirk. Landbofor. Fyns Ber. 1904–5, pp. 136–150*).—Through the agency of various experimental unions in Denmark the author obtained quite extensive data regarding the number of milch cows which go farrow. In 1902 there were 180 such cows in 2,508, or 7 per cent, while the number which aborted was 112, or 4½ per cent. In a total of 19,134 cows, 1,161 went farrow.

The causes of such sterility are believed by the author to be found in the reproductive organs of the cow, and are apparently to be sought in some disease which prevents the ripening of the eggs. In the majority of cases examined by the author the corpus luteum which develops during pregnancy failed to be absorbed after parturition, and so long as it is not absorbed the cow remains sterile. The operation of removing the corpus luteum from the surface of the ovary is not difficult, and in 70 to 90 per cent of cases after this was done the cow came in estrum within 3 or 4 days. The author believes that this treat-

ment in connection with suitable treatment for abortion will practically control the problem of sterility in milch cows.

Contagious abortion among cattle, A. H. Cory (*Queensland Agr. Jour., 16 (1905), No. 3, pp. 249, 250*).—A brief account is given of the cause, symptoms, treatment, and prevention of this disease. The antiseptic solutions recommended in the treatment of the disease are carbolic acid 1 : 100 parts of water or corrosive sublimate 1 : 2,000 parts.

Cowpox, Desmond (*Jour. Dept. Agr. So. Aust., 9 (1905), No. 5, pp. 328–334, figs. 4*).—This disease occurred in an extensive outbreak in a dairy which was later examined by the author. Seven cows were found to be affected in the herd. The usual antiseptic precautions are recommended in the control of the disease.

Eradication of African coast fever, C. E. Gray (*Transvaal Agr. Jour., 3 (1905), No. 12, pp. 696–699*).—Additional experiments on the life history of the brown tick, which is the main factor in the dissemination of African coast fever, indicate that it may be possible to stamp out the disease by the observance of certain precautions. If susceptible animals are kept away from infested fields for a period of 12 months they may then be allowed to graze on such ground. The explanation of this fact is that the ticks have died in the meantime. Tick starvation in connection with thorough dipping of infested cattle may lead to the eradication of the disease.

Further experiments to note how long an area remains infected with east coast fever, A. Theiler (*Transvaal Agr. Jour., 3 (1905), No. 12, pp. 700–706*).—On sheep allowed to graze with cattle infested with the brown tick, this tick was not found to occur in great numbers. The most prominent species on sheep were *Hyalomma ægyptium*, *Amblyomma hebræum*, *Rhipicephalus simus*, and *R. evertsi*.

Experiments were carried out by the author to determine the possibility of eradicating the disease from infected fields. It was found that as soon as the ticks were dead from starvation the area was no longer dangerous. Care must be exercised, however, to prevent other animals from carrying the ticks from place to place. In one instance, a brown tick was found on a wild hare.

It is recommended that as soon as the fever temperature appears in animals affected with African coast fever they be confined in inclosures so that ticks from them will be unable to get upon the pastures. The incubation period of coast fever is not more than 20 days. During this time ticks on cattle do not become virulent. It should also be remembered that the ticks do not acquire the blood parasite even after the first few days of the disease, and after the tick falls to the ground it must first undergo a moulting process before it is able to infest healthy cattle. This period lasts for not more than 20 days.

In experiments with virulent brown ticks the author was able to reproduce the disease in 8 out of 9 cases. It was also found that two ticks were sufficient to cause a development of fever.

Redwater in cattle and its treatment with Damholid, Westermann (*Berlin. Tierärztl. Wchnschr., 1905, No. 52, pp. 881, 882*).—In the early experiments carried out by the author in treating redwater with injections of Damholid, the animals all died of what appeared to be malignant edema. Later experiments, however, showed that if the inoculation was made during the early stages of the disease it always has a decidedly beneficial effect.

Good results are also obtained from the administration of 50 gm. of Damholid daily through the mouth. In most cases the treated cattle recovered entirely within 3 days. Damholid was also used in one case of advanced tuberculosis, being fed in water at the rate of 50 gm. per day. At the beginning of the treat-

ment the animal was greatly emaciated and weak, but within 4 weeks the health of the animal had greatly improved and it had apparently recovered from tuberculosis.

The cause of wooden tongue, M. P. RUKHLYADEV (*Uchen. Zap. Kazan. Vet. Inst., 22 (1905), No. 5-6, pp. 448-451*).—The literature of this subject is briefly reviewed, in connection with some experimental work of the author relating to the pathological histology of the tongue of cattle affected with actinomycosis.

A wasting disease of young cattle, L. A. KLEIN (*South Carolina Sta. Bul. 114, pp. 11*).—On 5 farms visited by the author, 72 out of 114 young cattle had been attacked by verminous gastritis. Of these animals, 44 had died, while only 2 had recovered, the others still being sick.

The parasite was found to be *Strongylus contortus*. An account is given on the history of this parasite with notes on the symptoms caused by it. The first symptoms appeared in August and September, and the deaths were most numerous in October and November. The disease appears, therefore, to be later in occurrence in the South than in the northern States. It is nearly always fatal since only 2 of the animals in question recovered, and these were nearly 2 years old.

Verminous gastritis is confined largely to young cattle under 1½ years of age. In some cases the disease occurred not only on low wet pastures but on hilly land. Excellent results were obtained from the use of coal-tar creosote given at the rate of 25 drops to 2 teaspoonfuls in a pint of water according to the age of the animals.

Cattle plague in Egypt in 1903 to 1905, W. LITTLEWOOD (*Jour. Compar. Path. and Ther., 18 (1905), No. 4, pp. 312-321*).—Apparently cattle plague was introduced into Africa during the last 20 years by the importation of cattle from Arabia. Data are presented showing the present distribution of the disease.

In outbreaks of cattle plague it is desirable to bury the carcasses of animals dead of the disease, but some difficulty has been experienced in having this done systematically. It was also necessary in some instances to close cattle markets during the progress of an outbreak. Since man is not affected by eating the meat of cattle affected with the disease, the use of such animals has served to spread the disease. The best treatment, in the author's opinion, is the use of serum wherever this material is to be conveniently obtained. Notes are also given on the use of bile and a combination of blood and serum.

Malarial catarrhal fever (blue tongue) of sheep in South Africa, J. SPREULL (*Jour. Compar. Path. and Ther., 18 (1905), No. 4, pp. 321-337, figs. 10*).—This disease has been recognized in South Africa since 1880, but its nature and etiology were not systematically studied until 1900. The lesions which occur in blue tongue are chiefly confined to the mouth and feet and are accompanied by fever.

The disease prevails extensively in Cape Colony, Bechuanaland, British Protectorate, and Transvaal. It has been observed that sheep are less susceptible to the disease when the wool is long than when it is short, and some protection is afforded when they are kept in sheds at night. Apparently, therefore, some blood-sucking insect is concerned in the spread of the disease, since infection does not take place by mere contact. The period of incubation is 2 to 5 days, and the mortality varies from 5 to 30 per cent.

The author used chlorid of potash with tannic and boric acid as a treatment for the lesions in the mouth. Rest and cool surroundings are recommended in cases of the disease. Blue tongue may sometimes be prevented from spreading further by removing the herd of sheep to another grazing ground, especially if

this be at a higher altitude. The micro-organism of the disease is believed by the author to be ultramicroscopic.

No immunity was produced by the use of bile from affected animals, and this treatment appeared to be somewhat dangerous. The results obtained from the inoculation of blood of recovered animals gave varying results. Apparently such blood gradually becomes more attenuated, and in some instances can be used with success. The disease may be transmitted by inoculation to goats and cattle.

Blue tongue in sheep, A. THEILER (*Transvaal Agr. Jour., 3 (1905), No. 12, pp. 685–696*).—This is an infectious disease attacking chiefly the mucous membranes of the mouth, nose, and intestines, and sometimes causing inflammation of the feet. The popular name is derived from the bluish discoloration of the lips, tongue, and gums.

The disease is quite similar to the so-called catarrhal fever of sheep, but is believed to be specifically distinct. It is distributed quite largely throughout the Transvaal, but does not occur every year to a serious extent. The period of incubation is 4 days and the fever temperature may rise to 107° F. The disease is fatal only in a small percentage of cases, and in these cases the mouth is the seat of the principal lesions. The lungs become edematous and minute blood spots appear under the endocardium.

The disease appears not to be transmitted by mere contact. It is, however, due to a micro-organism, as shown by the fact that the serum of the blood of affected animals is exceedingly virulent. The micro-organisms, however, appear to be ultramicroscopic. The disease can not be transmitted to horses, but may be transmitted to goats. One attack produces considerable immunity, and the serum of hyperimmunized animals may be used in vaccinating other animals to prevent the development of the disease.

Scab and its eradication, C. E. GRAY (*Transvaal Agr. Jour., 3 (1905), No. 12, pp. 669–675, pl. 1*).—Hand dressing of sheep infested with scab mite is not recommended. The formula for lime-sulphur dip as proposed by the Department of Agriculture of Cape Colony calls for 25 lbs. of sulphur and 20 lbs. of lime per 100 gal. of water. This dip and the formula recommended by the Bureau of Animal Industry of this Department are both considered effective.

Infestation of lambs with flies, O. JORDAL (*Norsk Vet. Tidsskr., 17 (1905), No. 6, pp. 121–124*).—Young lambs are frequently attacked by flies such as *Musca cæsar*, *M. sericata*, etc. The extent of this infestation in Holland, Germany, and Norway is briefly indicated. In certain cases favorable results were obtained from the use of turpentine, pyrol, or benzine.

The characterization of hog cholera group, A. BÖHME (*Ztschr. Hyg. u. Infectionskrank., 52 (1905), No. 1, pp. 97–110*).—According to the author's investigations the bacillus of psittacosis belongs with the hog cholera group as well as the true hog cholera bacillus, paratyphoid bacillus, and some of the bacteria of meat poisoning.

Among the meat-poisoning bacilli the so-called Moorseele bacillus is somewhat typical. Serum obtained from animals affected with psittacosis exercises a preventive or slightly immunizing action against all bacilli of the hog cholera group and appears to be more generally effective in this regard than the sera from other organisms belonging to the group. The psittacosis serum also agglutinates typhoid bacilli.

Heartwater and horse sickness: A new protective inoculation against horse sickness, J. M. COUTTS (*Jour. Compar. Path. and Ther., 18 (1905), No. 4, pp. 337–345*).—A report is made on 7 cases of inoculation of horses with heartwater. Heartwater and horse sickness are very similar in appearance.

Both diseases may be transmitted by inoculation, but neither is infectious. The micro-organism appears to be ultra-microscopic, both are peculiar to South Africa, and the post-mortem appearances are similar.

In the author's experience it is somewhat difficult to inoculate horses with heartwater, but when such inoculation is successful the post-mortem conditions are similar to those of horse sickness. Animals which recover from the inoculation show some immunity against horse sickness. The author recommends 4 inoculations of the blood from animals recovered from heartwater in producing immunity against horse sickness.

The identity of surra and mbori, A. LAVERAN (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 26, pp. 1204–1207*).—The results obtained by the author's investigations indicate quite clearly that trypanosomes found in cases of surra and mbori in camels and other animals belong to the same species *Trypanosoma evansi*. The forms obtained in these two diseases may be varieties of the same species, but mutually vaccinating properties are observed.

The pathological histology of experimental infection with Trypanosoma brucei, E. SAUERBECK (*Ztschr. Hyg. u. Infectionskrank., 52 (1905), No. 1, pp. 31–86, pls. 2*).—In the author's experiments with this organism it is found that with rats, guinea pigs, rabbits, and dogs infection leads to death within a few days in the case of dogs and rats, and within a few weeks or months in the case of guinea pigs and rabbits.

The trypanosomes increase regularly and constantly in number in rats and dogs, but are irregular in their occurrence in guinea pigs and rabbits. In the case of some of the experimental animals the immediate cause of death appeared to be found in excessive irritation of the brain. The trypanosomes apparently do not develop irregular forms in the blood, but only in the lymphatic glands, spleen, bone marrow, liver, and lungs. The irregular forms are the same as appear in the blood after death.

In the lymphatic glands, spleen, and bone marrow it is not the endothelial elements but the free cells which are most altered by the development of large nuclei. The cell multiplication in such structures precedes hyperemia and enlargement of the organ. The author was unable to find any parallelism between the duration of resistance to the disease and the degree of phagocytosis.

Immunization against tsetse-fly disease, C. SCHILLING (*Ztschr. Hyg. u. Infectionskrank., 52 (1905), No. 1, pp. 149–160*).—Material for the author's investigations was obtained from a horse affected with the disease and the blood parasites were transferred by numerous inoculations in gray rats and dogs. The parasites were also found in considerable numbers in cattle.

It was found during these experiments that frequently the peripheral blood of affected animals contains none of the blood parasites. Goats are very resistant to nagana. Experiments were tried in killing the blood parasites in the peritoneal exudate of affected dogs and using this material for immunization. The results, however, were not constant.

Trypanosomiasis in camels, A. THEILER (*Transvaal Agr. Jour., 3 (1905), No. 12, pp. 717–721*).—Trypanosomiasis broke out in a herd of 36 camels which were imported from Somaliland.

Blood was taken from those camels which were evidently diseased and ultimately from all the camels and used in inoculation of dogs. It was found that only two camels were free from the disease. Since later some doubt appeared regarding the health of these two animals, all of the camels were killed for the purpose of stamping out the infection. The disease in question was apparently surra or a closely related infection.

The etiology of so-called horse typhoid or petechial fever, BARUCHELLO and MORI (*Deut. Tierärztl. Wchnschr., 13 (1905), No. 51, pp. 589–592*).—The disease

in question is apparently closely related to malaria. The development of fever occurs suddenly and assumes an acute form. Death may result within 2 or 3 days.

Quite satisfactory results were obtained from the use of subcutaneous and intravenous injections of quinin. The blood parasites may be easily obtained and stained for examination. A detailed description is given of these parasites in their different developmental forms. Intravenous inoculation of blood from affected animals failed to produce the disease in horses, rabbits, and guinea pigs. Apparently the disease is transmitted by means of insects, perhaps mosquitoes.

The bacterial flora of the nasal cavity of the horse, De Angelis (*Rec. Méd. Vét., 83 (1906), No. 1, pp. 31-35*).—According to the author's investigations a staphylococcus and streptococcus are constantly found in the nasal cavity of the horse. These organisms are not pathogenic for laboratory animals, but may produce local or even generalized infection in the horse. These micro-organisms are identical with nonpathogenic forms in their morphological and pathological characters. Repeated occurrence of them in horses does not produce immunity.

The occurrence of the tetanus bacillus in animal feces, A. Hoffmann (*Hyg. Rundschau, 15 (1905), No. 24, pp. 1233-1239*).—In the author's experiments cultures were used from the feces of sheep, horses, and cattle in inoculating mice for the purpose of determining whether tetanus bacilli were contained in this material. In the 22 experiments carried out along this line, tetanus was produced in only one case. It appears, therefore, that the feces of animals which bear wounds at the time may contain tetanus bacilli in sufficient numbers to cause infection.

The destruction of rabies virus in the peritoneal cavity, P. Remlinger (*Compt. Rend. Soc. Biol. [Paris], 59 (1905), No. 38, pp. 689, 690*).—It has long been known that the virulence of pathogenic bacteria may be increased when these micro-organisms are kept in collodion sacs, or otherwise in the body cavity of susceptible animals, and also by repeated passage by means of hypodermic or intravenous inoculations through animals. When rabies virus, however, is placed in the body cavity of dogs and rabbits the opposite effect is observed.

In the author's experiments samples of virus thus treated were removed every day and used for inoculating experimental animals. It was found that none of the animals inoculated after more than 24 hours had passed was affected. The rabies virus was completely destroyed by remaining in the peritoneum for 24 hours.

The diagnostic value of Negri's corpuscles, Bohne (*Ztschr. Hyg. u. Infectionskrank., 52 (1905), No. 1, pp. 87-96, pl. 1*).—In the investigations reported in this paper the author came to the conclusion that Negri's corpuscles must be looked upon as of specific diagnostic value for rabies. If tissue from suspected animals is embedded by the quickest known methods it is possible to arrive at a positive diagnosis within a few hours. In case the result is negative it is desirable to make a test by means of animal inoculation. The exact nature of Negri's corpuscles is not certain, and in the present state of knowledge the author believes that their parasitic nature is somewhat doubtful.

The nonvirulence of milk of rabid herbivorous animals subjected to intravenous injections of rabies virus, J. Nicolas (*Jour. Méd. Vét. et Zootech., 56 (1905), Dec., pp. 721-726*).—The author's experiments were carried out on goats and cows, and the milk obtained from inoculated animals was used in the inoculation of laboratory animals.

It was found that the milk and mammary tissue of herbivorous animals suffering from rabies is never virulent. In goats and cows subjected to

repeated intravenous injections of rabies virus the milk showed no virulence. It is suggested therefore that the milk of such animals may be used without danger.

Paralysis of the lower jaw in dogs independently of rabies, DAUPHIN (*Rec. Méd. Vét., 83 (1906), No. 1, pp. 28–30*).—In several instances, the author has observed paralysis of the lower jaw in which the dog was certainly not affected with rabies. Since this symptom is depended upon to some extent in suspected cases of rabies, the observations of the author make it desirable to exercise greater precaution in reaching a diagnosis.

Esophageal spiropterosis in dogs in southern Tunis, LE MAITRE (*Rec. Méd. Vét., 83 (1906), No. 1, pp. 17–24*).—The climate of Tunis has been found to be very unfavorable for European dogs. A large proportion of them die of distemper, rabies, and a sort of malarial fever accompanied with anemia and esophageal spiropterosis, the latter being most important.

This disease is due to the presence of *Spiroptera sanguinolenta* in the esophagus of infected dogs. The author made observations on a number of cases of this disease and found that at least ⅓ terminated fatally. The disease is most prevalent in spring and summer. There appears to be an undetermined intermediate host of this parasite. It is impossible to recognize the earliest stage of infestation. As soon as the disease can be recognized it is desirable to administer emetics and anthelmintics. The author prefers turpentine for this purpose.

Internal mycoses and the micro-organisms which cause them, P. SAVOURÉ (*Arch. Par., 10 (1905), No. 1, pp. 5–70, figs. 20*).—Elaborate descriptions, with notes on their life history, are given for various species of Mucor, Rhizopus, Rhizomucor, and Aspergillus. Certain species of these genera have long been known to cause pathological lesions in animals and man.

It was found that these genera may cause the formation of tubercles in susceptible animals which are characterized by a disintegration of the tissues and sometimes of the whole organ. As a rule, susceptible animals appear to show a certain amount of resistance to the spores of these molds, due to the phagocyte action of the endothelial cells of the blood vessels.

A series of experimental inoculations were made on rabbits, during which various species of these genera were used. *Mucor racemosus* was found to be nonpathogenic. More or less serious lesions were caused by *M. corymbifer, M. regnieri, M. truchisi, Rhizopus equinus, Rhizomucor parasiticus, Aspergillus fumigatus, A. oryzæ*, and *A. sulphureus*.

Toxic substances produced by animal parasites, R. BLANCHARD (*Arch. Par., 10 (1905), No. 1, pp. 84–104*).—An elaborate study was made of animal parasites of various orders, and the author comes to the conclusion that all animals including parasites of all groups secrete toxins which exercise more or less active effects.

The parasites of the intestines, including nematodes, tapeworms, flukeworms, etc., produce toxins which are, however, eliminated by the intestines of the host without producing any serious consequences. Parasites in the blood such as Filaria, Bilharzia, etc., cause a very slight intoxication, while the toxins produced by the blood-infesting protozoa such as trypanosomes are eliminated through the kidneys.

RURAL ENGINEERING.

Reports on the irrigation service in Upper and Lower Egypt, A. L. WEBB and R. E. VERSCHOYLE (*Rpt. Pub. Works Dept. Egypt, 1905, pp. 51–169, pls. 6*).—These reports are part of a complete report upon the administration of the Public Works Department in Egypt for 1904, by Sir William Garstin, and are of

interest as showing the practical working of the elaborate English administrative system on the Nile.

They consist largely of detailed statements of expenditures, with descriptions of new work started and repairs made, and of gage-height records, showing the use made of flood and reservoir water and its distribution among the basins and canals. The duty of water is discussed, the actual duty observed running from 80 to 105 acres per cubic foot per second for general crops, twice as much water being used on rice. The season is not given in this connection, but appears to be 90 to 100 days. A report on drainage works and roads is included.

Typical examples of sewage irrigation, P. EHRENBERG (*Fühling's Landw. Ztg.*, *54* (*1905*), *No. 24*, *pp. 831–847*).—After showing the value of sewage as a fertilizer, the author points out that its continuous discharge demands constant care day and night through the year, to distribute the sewage over the land, and that in many cases it must be applied regardless of injury to the crop, since its disposal is the paramount object.

There are, however, certain plants which resist overirrigation and which are hence particularly useful here. Among field crops hemp and asparagus would be ideal plants did they not entail much hand labor and a large investment. Beets require disking and are uncertain in starting. Even corn fodder does not meet the conditions wholly and is inferior to grass (*Rieselgrass*) which is the best crop of all.

Next in importance is truck raising. The very quick-growing vegetables are grown on freshly-irrigated land, and harvested without further application of sewage. Other vegetables are hilled up to prevent actual contact with the sewage. The distance from market must be short enough so that truck may be gathered and sold the same day. Nightshade and other stubborn weeds flourish in autumn when the gardener is busiest, and cause much trouble, since mowers can not be used on account of the dikes and checks. Near Berlin are over 500 lessees of sewage-irrigated lands which aggregate nearly 4,500 acres. The annual rental in 1904 was $22 per acre.

In irrigating grass land, sewage may be applied summer and winter in great excess without injury, and the yield is phenomenal. In 1904, 22.2 tons of fresh-cut grass per acre was reported, and in 1889, 26.2 tons. Mowing machines have not come into use, the most primitive methods prevailing. Without roadways through the fields the hay must be carried out on litters.

The author includes a number of tables showing the value of sewage, rental of land, yield of crops, seed required, etc., and a discussion of fresh-cut grass as a milk producer.

Reservoirs, M. RINGELMANN (*Jour. Agr. Prat.*, *n. ser.*, *10* (*1905*), *No. 51*, *pp. 787–790*, *figs. 6*).—An elementary discussion of the design of earth dams.

Weir experiments, coefficients, and formulas, R. E. HORTON (*U. S. Geol. Survey*, *Water-Supply and Irrig. Paper No. 150*, *pp. 188*, *pls. 38*, *figs. 16*).—This paper is a compilation of the work of Francis, Fteley and Stearns, Bazin, Hamilton Smith, Thomson, Cippoletti, and others on thin-edged weirs, and the experiments of Bazin, the U. S. Board of Engineers on deep waterways, the U. S. Geological Survey at the Cornell University hydraulic laboratory, and others on weirs of irregular cross section. The coefficients of Bazin are recomputed so as to cover more general cases. Submerged weirs and weir discharge under varying heads are discussed at length.

The good roads problem in Iowa (*Iowa Engin. Sta. Bul.*, *2* (*1905*), *No. 6*, *pp. 24*, *pls. 15*, *dgms. 2*).—The work of the Iowa Highway Commission since its creation in 1904 is described, with data showing the general road situation and the funds available for improvements. Drainage and the use of the King road

drag are urged as a solution of the problem for earth roads. The annual cost of maintenance does not exceed $3 per mile. Culverts and short bridges of reinforced concrete are advised.

Although a general lack of road metal over the State is admitted, the commission states that "we believe the earth road is not a permanent solution of our road problem, so far as the main traveled roads are concerned. In every county the network of main traveled roads should in the end be made permanent hard roads, surfaced with broken stone, if possible, and at least with gravel." But it adds: "We do not advise the construction of roads which cost $5,000 to $10,000 per mile to build, and $100 per mile per year to maintain, unless for a very few very important roads. We advise, rather, the construction of such stone roads as can be built in this State and others at costs of $1,200 to $2,500 per mile, and of gravel roads such as are being built in this State for $400 to $600 per mile where the gravel is found near at hand."

The use of cement for farm purposes, S. M. WOODWARD (*Municipal Engin., 30 (1906), No. 2, pp. 99–102*).—The possible scope of concrete as a material for farm buildings, floors, approaches, fence posts, troughs, and other farm purposes is briefly outlined, and its uses in California for irrigation structures are described at more length. Cost data for ditch and reservoir linings and for cement pipe in small sizes are given.

Denaturized alcohol for farm purposes, C. J. ZINTHEO (*Gas Engine, 8 (1906), No. 1, pp. 6–9*).—A review of the possibilities in the use of alcohol made from waste farm products for heat, light, and power, showing the urgent necessity of free alcohol for industrial purposes.

Any farm product containing large percentages of starch or sugar, such as grains, potatoes, beets, and cornstalks, may be used. Distillers claim that corn at 40 cents will produce 94 per cent alcohol at 13.5 cents a gallon, and that it has been made at a cost as low as 8 cents. It has been sold for 18 cents a gallon over the tax. While its heating power is about half that of gasoline, its combustion is so much more perfect that it is about as efficient, gallon for gallon.

European governments have all removed the tax on denaturized alcohol, and large areas are devoted to crops for producing it. In America free alcohol would not only insure cheap power, but would steady the price of corn, and absorb local overproduction of other crops.

Straw as a substitute for coal, C. VOITELLIER (*Jour. Agr. Prat., n. ser., 10 (1905), No. 48, pp. 686–688*).—The caloric value of straw is less than one-fourth that of coal, and this fact, added to the difficulty of firing with straw, makes it a poor fuel for steam boilers. The writer states, however, that when made into producer gas and used in a gas engine, 1 kg. of straw will yield as much power as 3 or 4 kg. of coal used to produce steam. Compared with coal at 40 francs per ton, the power value of straw on this basis would be 150 francs per ton, or something like $35 per acre for an average yield. The straw should be baled, and for the sake of economy power plants should be concentrated in 70 to 100 horsepower units.

The capacity of wind motors, M. RINGELMANN (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 18, pp. 688, 689*).—The experiments recorded were made on a 12-ft. mill with wooden vanes, and bear out former tests in showing that with a constant load the rate of work varies as the first power of the wind velocity. An analytical explanation of the reduced efficiency at higher velocities is offered, which shows that the effective area presented to the wind tends to diminish as the ratio of wheel rate to wind velocity increases. The method of determining the most effective load for a particular locality from daily wind records is given.

A note by M. Ringelmann on the same experiments is found in *Jour. Agr. Prat.*, n. ser., 10 (1905), No. 48, pp. 686–688.

New farm machinery, B. MARTINY (*Fühling's Landw. Ztg.*, *55* (*1906*), *No. 2*, *pp. 68–72*, *figs. 3*).—Two straw cutters are described, one having a number of star-shaped knives on the same shaft, which project upward through slits in the bottom of a long hopper when the shaft revolves. The other has two heavy knives which revolve on one spindle and alternately cut the straw fed through an ordinary chute.

Lucerne cultivators (*Agr. Jour. Cape Good Hope*, *28* (*1906*), *No. 1*, *pp. 49–51*, *figs. 4*).—Three types of cultivators for alfalfa are described. One is provided with rotary pickers mounted on a large pair of wheels, and is intended for irrigated land; another is the common wheel cultivator, with special lucerne teeth; the third consists of a heavy spiked roller.

Practical cold storage, M. COOPER (*Chicago: Nickerson & Collins Co.*, *1905*, *pp. 576*, *figs. 213*).—As stated in the preface, "this book is intended to cover the field of applied refrigeration with the exception of ice making, ice machines, and the technical and theoretical side of the mechanical production of refrigeration," and is a comprehensive treatise on the construction and management of cold-storage plants of all kinds.

The four objects of refrigeration are stated to be to prevent the premature decay of perishable products, to lengthen the period of consumption and thus greatly increase production, to enable the owner to market his products at will, and to make possible transportation in good condition from point of production to point of consumption irrespective of distance. The author takes up in detail the subjects of insulation, air circulation, ventilation, and the control of humidity in plants using artificial methods of refrigeration. He next deals with the storage of particular products in order of their importance, including eggs, butter, cheese, general creamery and dairy refrigeration, fruit, fish, fabrics, and furs.

The shipping of meat and other perishable products, and ice refrigeration in general are thoroughly treated, and methods of harvesting, handling, and storing ice, and approved methods of building ice houses of all sizes are fully described. The book is full of figures and drawings showing details of construction. A number of tables are included, showing the relative insulating qualities of various materials, etc., and a table of cold storage and freezing temperatures for various products is appended.

The extremely recent development of refrigeration is shown by the statement that scarcely any of the printed matter published earlier than 1895 was found of use in writing this book. The cold storage of furs and fabrics is a recent development which is likely to prove an important use of refrigeration.

AGRICULTURAL EDUCATION.

Annual report on the distribution of grants for agricultural education and research (*Bd. Agr. and Fisheries* [*London*], *Ann. Rpt. Agr. Ed. and Research*, *1904–5*, *pp. X + 209*).—This consists of a general report on the work of the year, a list of grants awarded in 1904–5, and 4 appendixes: (1) Reports on institutions receiving grants, (2) education in rural districts—school gardens, (3) summary of the agricultural instruction provided by county councils in England and Wales in the year 1904–5, and (4) statement showing the expenditure of county councils in England and Wales upon agricultural instruction in the years 1903–4 and 1904–5.

In the general report attention is called to an increase of $4,856 in the amount given to local institutions in aid of agricultural education. One-half of this sum

was awarded in two equal grants for lectureships in forestry at the University College of North Wales, Bangor, and Armstrong College, Newcastle-upon-Tyne. The sum of $971.20 was given to aid "the excellent scheme of instruction provided by the County Council of Essex at their technical laboratories in Chelmsford," and $971.20 and $485.60, respectively, to the agricultural departments of the university colleges of Reading and Aberystwyth on account of the establishment of farms in connection with these institutions.

The statement is made that the principal reason for giving financial assistance to educational institutions was to provide facilities for training young men for the practice of agriculture, but it is considered noteworthy that a large percentage of "the best students have been attracted from the practice of agriculture by the offer of research and teaching appointments, and are now filling many of the more important chairs and lectureships" in England, as well as important positions requiring trained specialists in the colonies of Great Britain and other parts of the world. It is recognized that "agricultural science offers to our best students a career which is certainly not less attractive than that presented by the older and more conventional professions."

A feature of the work of the different colleges, aided by the board during the past year, has been the attention given to the training of teachers for the elementary schools. Short courses, usually extending over 2 weeks, have been given for teachers at many of these institutions. In this work the county councils have frequently cooperated. The courses have included instruction in nature study, horticulture, economic entomology, dairying, school gardening, and other subjects of this nature. The attendance of teachers at Reading University College was 25; at Wye College, 67; at the University College of Wales, 42; at the Midland Agricultural and Dairy Institute, 61; at Harper-Adams College, 13; and at the Essex County Technical Laboratories, 30.

In the appendix on "Education in Rural District—School Gardens," detailed information is compiled from replies to 33 questions sent by the Board of Agriculture and Fisheries to the different county councils. These questions and answers relate to gardens connected with both day and evening schools and to the sources from which land, funds, seeds, and tools are supplied; the total area in gardens and the size of each plat; the instructors, their training and compensation; the number and ages of children doing garden work; the time devoted to this work; systems of cropping; supervision; systems of prize giving, and disposal of products. From the replies received, it appears that at least 32 counties have gardens connected with day schools, and 22 counties maintain other gardens either connected with evening schools or worked independently by boys and young men.

In the case of the day-school gardens, it appears that in most counties land and tools, and in a few counties seeds, are provided either directly or indirectly by the county councils. The seeds are usually provided by the local school authorities. The size of the gardens ranges from $\frac{1}{8}$ to $\frac{1}{4}$ of an acre, and the size of the individual plats from 1 to 3 square rods. Custom varies as to whether each pupil shall have a separate plat or whether the land shall be worked in common. The teachers of gardening are usually the head teachers in the schools, who in many counties are required to have credentials of qualification for this work. Sometimes gardeners are employed as instructors, though this arrangement is not very satisfactory. The ages of the pupils in gardening range from 9 to 15 years, with comparatively few less than 11 years. Two hours a week is given as the general average of time devoted to gardening.

There is no general system of cropping or prize giving, and only a few counties in which the work is under the supervision of a county instructor in horticulture, though this last is considered highly desirable. The produce in some

cases becomes the property of the boys, in others it is disposed of by the school and the proceeds used for the purchase of seeds or for the benefit of the class, and in others it is taken by the teacher, though the latter practice is not commended.

The agricultural instruction provided by the different county councils is quite varied in nature. It includes aid to the agricultural departments of colleges; employment of instructors in agriculture, dairying, poultry keeping, bee keeping, and farm hygiene; the management of field experiments, experimental farms, and fruit-growing stations, and the support of classes in horseshoeing, manual training, horticulture, and school gardens, as well as the partial support of training classes for elementary teachers. Not all of the councils carry on work in all of these subjects, but each subject receives some attention in many different counties of England and Wales.

The receipts of the county councils from the Customs and Excise Act of 1890 have decreased considerably in recent years, but notwithstanding this fact the county councils were able up to last year to increase the amounts devoted to agricultural education. The total amount received in 1903–4 was $3,369,340, and of this amount $424,764 was devoted to agricultural education in 1904–5, as follows: General expenditures, $47,997; dairy instruction, $63,512; agricultural lectures, $22,940; poultry keeping, $15,272; horseshoeing and veterinary science, $13,296; bee keeping, $5,677; horticulture, $50,818; manual processes, $6,264; miscellaneous, $19,633; scholarships, $51,240; and grants to colleges and schools, $128,597.

Agricultural instruction for adults in continental countries, J. HAMILTON (*U. S. Dept. Agr., Office Expt. Stas. Bul. 163, pp. 32*).—This bulletin is intended to supplement Bulletin 155 of this Office on Agricultural Instruction for Adults in the British Empire. It includes a discussion of systems of itinerant instruction in agriculture in Austria, Belgium, Bulgaria, Denmark, France, Hungary, Italy, Netherlands, Prussia, Russia, and Sweden, together with notes on some fixed agricultural schools for adults.

Statistics of land-grant colleges and agricultural experiment stations, 1905, MARIE T. SPETHMANN (*U. S. Dept. Agr., Office Expt. Stas. Circ. 64, pp. 9*).—Abstracts of statistics to be published later in full in the Annual Report of the Office of Experiment Stations.

Negro agricultural and mechanical colleges, J. H. BLUFORD (*South. Workman, 35 (1906), No. 1, pp. 28–35, figs. 6*).—A general discussion of the origin and present status of agricultural and mechanical colleges for negroes is followed by a more detailed description of the courses of study and equipment of the Agricultural and Mechanical College for the Colored Race at Greensboro, N. C.

This institution is said to occupy a unique position among negro schools in confining all of its instruction to agriculture, the mechanic arts, the English language, and the sciences underlying the same, limiting its instruction to males who have completed grammar school work, providing a very complete equipment, and graduating an unusually large percentage of students from its agricultural course.

Teaching agriculture in the common schools, G. SEVERANCE (*Northwest Jour. Ed., 17 (1905), No. 3, pp. 6–10*).—After discussing in a general way the need of agricultural teaching in the common schools and indicating the aim of such teaching, the writer gives a list of inexpensive materials needed for illustrative purposes, and outlines 9 exercises relating to soils and cultivation.

The relation of geography to nature study in the elementary school, H. W. FAIRBANKS (*Nature Study Rev., 1 (1905), No. 5, pp. 173–188*).—In making a

comparison between geography and nature study in the elementary schools a plea is made for the more uniform and rational treatment of both subjects.

Nature study is defined and differentiated from science. Geography in the earlier years of school life is said to deal from the same standpoint with practically the same materials as nature study, and the two should not be widely differentiated during the first 4 years of school work. After that geography should begin to deal with facts beyond the experience of the pupil, while nature study should still be largely confined to the home district.

The intimate relation existing between geography and history is also pointed out, and an outline is given of a course of study in nature study, geography, and history for the elementary school. This course is developed by grades under the term nature study (modified by the adjectives institutional, industrial, biological, physical, agricultural, geographical, and historical) until the end of the fourth grade, after which nature study is outlined as one subject of study and geography and history as another.

Studies of corn and its uses, F. H. RANKIN (*Agr. Col. Ext. Univ. Ill.* [*Circ.*], *1905, May, pp. 40, figs. 8*).—This circular presents an elementary, systematic study of corn designed to aid boys and girls in acquiring a knowledge of facts and principles in agriculture to prepare them for the successful practice of some branch of farming.

Notes and outlines are given with a view of studying the corn plant as a whole, the ear in connection with the use of a score card, and different features of corn culture and characteristics of the crop by experimentation. Notes on the composition of the different parts of the corn kernel are reproduced from Illinois Station Bulletins 43, 55, and 87 (E. S. R., 8, p. 509; 11, p. 633; 15, p. 352), previously noted. A brief discussion of the commercial products of corn is also given.

Experiments with milk and butter, J. W. DECKER (*Agr. Col. Ext. Bul.* [*Ohio State Univ.*], *1* (*1906*), *No. 4, pp. 4–10, figs. 10*).—Nine simple dairy experiments suitable for elementary schools are described and fully illustrated.

An elementary study of soil, A. B. GRAHAM (*Agr. Col. Ext. Bul.* [*Ohio State Univ.*], *1* (*1906*), *No. 4, pp. 11–14, figs. 5*).—Ten simple exercises with soils are described.

Window gardening in the schoolroom, H. B. DORNER (*Purdue Univ.* [*Pamphlet*], *1905, pp. 23, figs. 10*).—This is a pamphlet prepared by a practical florist, and gives directions for the propagation and care of plants in the schoolroom. The purpose of the pamphlet is to give teachers an insight into the habits and requirements of plants which may be used both as objects for nature study and for the beautification of schoolrooms.

MISCELLANEOUS.

Annual Reports of the Department of Agriculture, 1905 (*U. S. Dept. Agr. Rpts. 1905, pp. CXXXIV+569*).—This is made up of the reports of the Secretary and heads of Bureaus. The various reports are also issued as separates.

Eighteenth Annual Report of Alabama College Station, 1905 (*Alabama College Sta. Rpt. 1905, pp. 28*).—This includes the organization list of the station, a financial statement for the fiscal year ended June 30, 1905, and brief reports of the director and heads of departments. The report of the horticulturist contains a list of certificates granted nurserymen.

Annual Report of Connecticut State Station, 1905 (*Connecticut State Sta. Rpt. 1905, pt. 1, pp. 1–8*).—These pages contain an announcement concerning the work of the station, a report of the board of control, and a financial statement for the year ended September 30, 1905.

Eighteenth Annual Report of New York Cornell Station, 1905 (*New York Cornell Sta. Rpt. 1905, pp. XXIX+525+46*).—This report, which is not intended for general distribution, contains the organization list of the station, reports of the director and heads of departments, a financial statement for the fiscal year ended June 30, 1905, and reprints of Bulletins 221–232 of the station on the following subjects:

Alfalfa in New York (E. S. R., 16, p. 355); record of an attempt to increase the fat in milk by means of liberal feeding (E. S. R., 16, p. 695); the grape-berry moth (E. S. R., 16, p. 681); two grape pests (E. S. R., 16, p. 681); bovine tuberculosis (E. S. R., 16, p. 1024); an apple orchard survey of Wayne County, New York—I, The apple industry (E. S. R., 17, p. 143); II, Geology (E. S. R., 17, p. 119); mushroom growing for amateurs (E. S. R., 17, p. 141); potato growing in New York (E. S. R., 17, p. 133); an apple orchard survey of Orleans County (E. S. R., 17, p. 367); quality in potatoes (E. S. R., 17, p. 358); forcing strawberries (E. S. R., 17, p. 467); notes on the forcing of tomatoes, cucumbers, and melons (E. S. R., 17, p. 463); and experiments on the influence of fertilizers upon the yield of timothy hay when grown on Dunkirk clay loam in Tompkins County, New York (E. S. R., 17, p. 461).

Director's report for 1905, W. H. JORDAN (*New York State Sta. Bul. 274, pp. 501–518*).—This is a somewhat detailed report of the work of the station during the year.

Eighteenth Annual Report of Rhode Island Station, 1905 (*Rhode Island Sta. Rpt. 1905, pp. 169–352 + VII*).—This contains the organization list of the station, a report of the director on the different lines of station work, and more detailed reports of the different divisions which are noted elsewhere, a financial statement for the fiscal year ended June 30, 1905, list of exchanges, and an index to the report and bulletins issued during the year.

The report also contains the following articles which have already been noted from other sources: The effect of postponing the ammonium-citrate treatment of the water-insoluble portion of fertilizers (E. S. R., 16, p. 322); phosphoric acid determinations by the method of ignition with magnesium nitrate and by that of digestion with acids (E. S. R., 16, p. 843); notes on the use of acetic and of oxalic acid for extracting the charred material in preparing ash (E. S. R., 17, p. 432); and the phosphoric acid removed by crops by dilute nitric acid and by ammonium hydroxid from a limed and unlimed soil receiving various phosphates (E. S. R., 17, p. 430).

Annual Report of Virginia Station, 1905 (*Virginia Sta. Rpt. 1905, pp. 36*).—This contains the organization list, a report of the director on the work of the station during the year, a financial statement for the fiscal year ended June 30, 1905, a summary of meteorological observations (see also p. 836), and departmental reports, some of which are noted elsewhere.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, vol. 7, Nos. 9, pp. 79–86; 10, pp. 87–94*).—These numbers contain brief statistical reports on the tobacco crop of 1905, by types; colonial cotton; rice production in the United States; cotton crop of the Department of Agriculture compared with the reports of the Census Bureau; crops of Russia; the corn and tomato pack in 1905; crop conditions in Europe; the cotton crop of British India; farm animals in the United States; oil seeds in British India; crops of Germany; foreign trade in the United States for 1905; the world's meat trade; demand for durum wheat; and numerous other topics.

NOTES.

Alabama College Station.—The station has concluded a feeding experiment with 50 head of steers, which was made in cooperation with the Bureau of Animal Industry of this Department. It represents the second year of this cooperation.

Colorado Station.—E. P. Taylor, assistant to the State entomologist of Illinois, has been appointed field entomologist of the station, with headquarters at Grand Junction. He will study the insects working in the orchards of that section, more especially the codling moth. O. B. Whipple, assistant horticulturist of the station, has been transferred to Grand Junction as field horticulturist to make a study of the orchard conditions of that locality and of plant diseases. A. H. Danielson, assistant agronomist, whose resignation was recently noted, is succeeded by F. Knorr, of Minnesota. E. R. Bennett, of the Connecticut Storrs Station, has been appointed field assistant for special work in potato investigations in the potato districts of northern Colorado. This work is undertaken partly with State appropriation and partly with funds raised by local subscription. The investigations on loco, carried on in cooperation between the station and this Department, will be on a more extensive scale this year than formerly. The headquarters will be at Hugo. The station will be represented by Dr. G. H. Glover, the veterinarian.

Connecticut College and Storrs Station.—The fifth annual summer school devoted to nature and country life will be held at the college July 3–27. Storrs Hall, the new brick and stone dormitory, will be ready for the use of the school.

Florida Station.—E. W. Berger, Ph. D., recently research student at Ohio State University, has been appointed entomologist to the station. N. Adams, of Jasper, has resigned as a member of the board of trustees and J. C. Baisden, of Live Oak, has been appointed to fill the vacancy. Contracts have been let for a greenhouse and seven other agricultural and horticultural buildings at the new location of the college and station at Gainesville, together with houses for the foremen of the horticultural and agricultural departments. The houses are to be completed in sixty days and the other farm buildings very soon.
that.

Iowa College and Station.—The legislature has appropriated $11,000 for the purchase of 135 acres of additional land, 80 acres of which will be used for grazing purposes and experimental work in animal husbandry, and 55 acres for orchard instruction and experimental work in forestry. An appropriation of $5,000 was made for buildings on the dairy farm, and an equal amount for the poultry plant; and $15,000 was provided for agricultural extension work, for the conduct of which it is planned to establish an extension department.

The one-fifth mill tax levy in favor of the institution was extended for a period of five years. This will provide about $125,000 a year for buildings. About $175,000 remains from the present millage tax, which will be applied on the new agricultural building, to cost $275,000. The building will be completed from the new millage tax. An appropriation of $5,000 annually was made for good roads instruction and investigation, $3,500 annually for an engineering experiment station, and $2,400 for library.

H. G. Van Pelt has been elected to the position of assistant in animal husbandry in charge of dairy stock. He will have charge of the 200-acre dairy

farm which has recently been purchased and which is now being equipped and stocked for experimental and educational work in dairy stock. This farm will be devoted exclusively to dairy and poultry work. The poultry department is being organized and will be equipped and ready for work at the opening of the next college year. W. J. Rutherford, assistant in animal husbandry, has resigned to accept a position at the new Manitoba agricultural college.

Massachusetts College and Station.—The State legislature has appropriated $75,300, in addition to the regular permanent appropriations, as follows: For erecting, heating, and equipping a building for the botanical department, $45,000; for a new barn and a new wagon house, $21,300; for a dairy building to be used simply for the handling of the farm product, $3,000; for a new piggery, $1,000; for repairs to buildings, $3,000; and for the further maintenance of the college, $2,000. The new buildings provided for, except that for the botanical department, are to replace those lost by fire. For the new barn an unexpended balance of insurance money amounting to $12,000 is also available. The permanent appropriation of the State to the college now amounts to about $57,000 annually.

Walter B. Hatch, assistant horticulturist in the station, has resigned, and Charles P. Halligan has been appointed his successor.

Kentucky Station.—Benj. R. Hart has been appointed assistant in charge of feed work.

Michigan College and Station.—Alfred R. Kohler has succeeded Albert G. Craig as instructor in horticulture in the college. Miss Dorothea Moxness has been appointed assistant chemist in the station. A farmers' institute corn special was run over the Lake Shore and Michigan Southern Railway in April. The principal topics discussed were the improvement of corn and better methods of corn culture.

Montana College and Station.—Peter Koch has retired from the executive board of the college and station, and has been succeeded by E. Broox Martin, of Bozeman. Mr. Koch will retain the position of secretary and treasurer of the board. Joseph B. Nelson, assistant agronomist of the Utah Station, has been appointed superintendent of the dry farm experiments over the State. Seven of these dry farm substations are being conducted this year, three in the northern part of the State and four in the southern part.

Nebraska College and Station.—The title of the department of agriculture has been changed to department of agronomy and the scope of this department enlarged to include instruction and experimentation in the chemistry of soils. Alvin Keyser and E. G. Montgomery have been appointed instructors in agronomy and assistant agronomists in the station. George A. Loveland, of the U. S. Weather Bureau, has been made meteorologist of the station, vice G. D. Swezey, resigned. F. G. Miller, professor of forestry in the State University, has been appointed forester of the station.

The station has entered into cooperation with the Bureau of Plant Industry of this Department to carry on spraying demonstrations in one orchard in each of six counties to determine the profit from such spraying operations. Records will be kept of the amount and quality of the fruit produced in each orchard where trees are sprayed as compared with similar trees unsprayed.

Ohio University and Station.—The legislature appropriated a total of $135,000 for the college of agriculture—$45,000 for land, $80,000 for buildings, and $10,000 for the purchase of live stock. The $80,000 for buildings will be used for a judging pavilion, a cattle barn, and a horse barn, all as separate structures.

The following appropriations for the work of the station have been made by the State for the two years, 1906 and 1907: Expenses of board of control, $1,600; bulletin publication, $10,500; special work in entomology, botany, horticulture, and chemistry, $19,000; substations for field experiments, $15,000;

general repairs, labor, and supplies, $20,000; special work in animal industry, $12,000; library equipment and care, $800; general construction, $8,000; cooperative experiments, $10,000; forestry investigations, $10,000; total, $106,900.

Porto Rico Station.—Winthrop V. Tower, a graduate of the Massachusetts Agricultural College, where he has been for the past two years pursuing post-graduate work in botany and entomology, has been appointed plant pathologist and entomologist to the station.

Rhode Island Station.—F. L. Yeaw, a graduate of Massachusetts Agricultural College, has been made assistant in chemistry in connection with the soil investigations, and J. Frank Morgan, a graduate of St. Lawrence University, assistant chemist to the station. Alton W. Richardson, of the senior class of the University of Maine, has been appointed assistant agronomist.

Washington Station.—Albert G. Craig, instructor in horticulture at the Michigan Agricultural College, has been appointed assistant horticulturist, vice D. C. Mooring, who resigned in January to accept a similar position in the Mississippi College and Station. Extensive experiments with cereals are planned for the coming year, especially with wheat, to which C. W. Lawrence will devote his entire time.

Better-Farming Special in New England.—The first attempt to introduce this form of university extension work into New England took the form of a so-called "better-farming special" train, which was run through Massachusetts, New Hampshire, and Vermont during April. The idea was fathered by an agricultural publication, which made the arrangements with the railroads, and was carried out by the colleges and stations in the three States. A week was spent in each State, the train being each week under the auspices of the college and station in which State it was running. The train consisted of four cars, which were equipped with apparatus and exhibits illustrative of farm crops, fertilizers, animal husbandry, dairying, horticulture, entomology, and forestry. One-third of each car was given up to the exhibits, the other two-thirds forming the audience room. Forty-minute stops were made at stations along the route, the first twenty minutes being devoted to two terse ten-minute talks in each car, followed by twenty minutes for viewing the exhibits and asking questions. The undertaking was pronounced a great success from start to finish. It is estimated that about 25,000 people visited the train during its course, and a large number of people were reached who had hitherto had little knowledge of the work of the colleges and stations.

Sugar Experiment Station in Peru.—The Peruvian Government has established an experiment station for sugar cane at Lima, under the auspices of the department of the interior. The station is organized under the directorship of T. F. Sedgwick, formerly of the Hawaii Station, who writes: "We already have land and a good laboratory. The work will consist in analyses of soils, fertilizers, sugar-house products, carrying on field experiments, and giving such aid to the planters as the station may be able to give."

Edinburgh and East of Scotland College of Agriculture.—The new buildings for this college were formally opened February 28 by Lord Balfour, of Burleigh. These buildings, according to *Nature*, are in Green Square, Edinburgh, and consist of well-equipped chemical, botanical, and bacteriological laboratories and lecture rooms, and class rooms for the various other subjects taught in the college. Their cost has amounted to more than $45,000.

International Association of Colonial Agronomy.—According to a note in *Nature*, it has been decided to establish an International Association of Colonial Agronomy, to promote the scientific study of the problems of colonial and tropical agriculture and of the commercial utilization of natural products. The

project took shape at a recent meeting of the French Association of Colonial Agriculture and Colonization. A provisional committee has been appointed to organize the association, with M. de Lanessan as president, and vice-presidents from Great Britain, Germany, Brazil, Italy, Mexico, Holland, Portugal, and France. The headquarters of the organization will be in Paris.

International Dairy Congress.—The Third International Dairy Congress will be held at The Hague during the month of September, 1907. The general secretary of the congress is Dr. A. J. Swaving, Lange Voorhout 88, The Hague, to whom applications for membership should be sent.

New Review of Hygiene.—The first number of the *Hygienisches Centralblatt* has been received. This is announced as a complete international review of matters pertaining to the whole field of hygiene, and is edited by Dr. Paul Sommerfeld, director of the laboratory at the Children's Hospital in Berlin, with the assistance of a large number of specialists. The first issue contains numerous abstracts of papers on drinking water, human nutrition, food materials, milk and dairy products, food inspection, and the meat industry. The abstracts are to be printed in German. The *Centralblatt* will be issued fortnightly.

Miscellaneous.—Prof. Nathaniel Southgate Shaler, dean of the Lawrence Scientific School and professor of geology at Harvard University, died April 10 at the age of 65 years. Professor Shaler had made important contributions in agricultural geology, notably upon soils and their origin.

Prof. Adolf Emmerling, director of the agricultural chemical laboratory of the experiment station at Kiel, and professor of agricultural chemistry in the university, died March 17 at the age of 64. He had devoted much study to the chemical processes within the plant, and especially the formation of albuminoids in plant tissues.

The death is announced of Georges Barba, director of the Enological Station of Nimes.

The Gardeners' Chronicle announces the death, March 20, of Count Oswald de Kerchove, chief of the directing council of the State Botanic Garden at Brussels, and the leading spirit in all public horticultural affairs in Belgium. He was also the author of a work on palms and another on orchids.

It is proposed to erect a marble bust of the late Prof. Th. von der Goltz in the agricultural academy at Bonn-Poppelsdorf, and to establish scholarships in his memory. A committee has been formed to solicit funds for the purpose.

Dr. A. J. Ewert, formerly at Birmingham, England, has been chosen professor of botany at the University of Melbourne, Australia.

The Academy of Sciences of the Institute of France has awarded the Thore prize to Prof. G. de Istvanffi, director of the Royal Central Institute of Ampelology of Hungary, on account of his investigations on the biology of the gray rot of grapes, due to *Botrytis cinerea*.

A station for testing agricultural machinery has been established at Breslau under the auspices of the chamber of agriculture of the Province of Silesia. It is under the directorship of Dr. Ernst Foerster.

The Royal Seed Breeding Institute of Wurttemberg was established at Hohenheim in December, 1905, under the directorship of Professor Fruwirth, with Dr. H. Lang as assistant.

It is announced in *Science* that about $50,000 has already been raised for the new professorship of lumbering in the Yale Forest School of the $150,000 which is sought as an endowment. In fourteen western States $44,000 was raised from sixty contributors, representing in the main corporations and firms.

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EXPERIMENT STATION RECORD.

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The outlining of plans for work under the Adams Act has led to greater consideration of what should be regarded as research in agriculture. The terms "research" and "investigation" have been used freely in reference to experiment station work, and often more broadly than they are employed in science generally. We have fallen into the habit of speaking of much of the work as investigation, which in a strict sense can not be regarded as of that grade. The result has been considerable confusion in the minds of station workers, as well as the general public, as to the distinction between this and other grades of work less technical and fundamental in character.

There are several reasons which contribute to this uncertainty in the use of terms. Agriculture is a new science. Our knowledge is not as well systematized and classified, and the problems for research are not so definitely outlined as they are in the older sciences. Being a composite science, it has been built up on the basis of the pure and natural sciences. It has drawn upon these for many facts, which have been given a scientific or a practical application in agriculture. Important as this application may be, it is not always to be regarded as research or a scientific discovery. All knowledge is supposed ultimately to have a useful application, and the work of the experiment stations has done a vast deal to demonstrate this fact and to give this knowledge a tangible value.

Again, the needs of agricultural practice have frequently blinded station workers and led them to mistake for investigation tests and demonstrations or simple experiments involving no original features, but which led to an answer to the farmer's question. They have been flooded with practical questions, and have set out to answer these questions in the most direct and quickest way. Results of this kind have accumulated very fast. The workers as a rule have been too busy and too much absorbed to stop long to philosophize or speculate upon the broader and deeper scientific aspects of their work or to inquire into the reason of the results observed.

Hence it is that much of our experimental work has given results which are largely empirical. We find that if we follow a certain programme of operations we will get a given result quite constantly. Why? Usually because this result has been observed in a variety of trials; not because the underlying principles have been determined, and the relation of these to the particular problem, as for example, that a given practice is found to have a special effect on the moisture conditions or aeration of the soil, or to bring about more congenial conditions for the organic life of the soil, or to have a definite effect on the physiological activities of the plant itself. The experimenter often sees only the final result, and is satisfied with this if it is favorable. The investigator will strive to determine the cause of what he sees and the broader bearings of the results of his experiments. This will stimulate him to make investigations into these problems which will go down to the fundamental facts and enable him to prove his proposition step by step.

These differences in the use of terms, which have grown up as a result of circumstances and environment, make it desirable that we should discriminate carefully and intelligently in applying the funds under a new act which restricts them to investigation. Such discriminating study of the different branches of the subject will be an aid in the development of agricultural science and will lead to a clearer view. It will enable the systematizing of investigations, so that we may go forward step by step in a logical way and as a result of things definitely worked out and proven. Until this is done we shall continue very largely to be groping in the dark, and not laying the foundation for scientific deductions which will help in the next set of problems or in another locality.

Some one has said that "Science seeks to make our knowledge of the small, the invisible, the mysterious, as accurate, as practical as our knowledge of common things;" and that "it seeks to make our knowledge of common things accurate and precise that this accuracy and precision may be translated into action." This fact finds expression in the results of many lines of research in agriculture. The intelligent use of lime is such an illustration, the combating of plant pests, the making and curing of cheese, the handling of milk, and a wide variety of other matters. But these subjects have each passed through their empirical stage before they reached a scientific basis.

For example, there was much experimenting upon the use of lime for land. Applications to some soils gave beneficial results, while on others there appeared to be no benefit, and it was thought by some to exhaust the soil and to be ill advised. A few years ago this represented the status of knowledge and experimentation. The results and the practice were entirely empirical. The lime was usually not needed

by the crops themselves, although it benefited them, but the purpose it served was not known, and there was no way of reasoning whether or not in a particular case lime would be helpful or its use advisable. Soil tests were relied upon for this purpose, and while they might be regarded as experiments, in themselves they did not comprise an investigation.

There were research problems which experience and these experiments had suggested, and after a while these problems became the subject of investigation. The effect of lime in correcting an acid condition of the soil was observed; the relations of this changed reaction to the biological factors of the soil were worked out; and gradually from these and other facts a basis was formed for the philosophy of liming. Through research the knowledge of this common practice had been made "accurate and precise," and this accuracy and precision had been "translated into action."

The combating of plant diseases and insects furnishes similar illustrations. We have come to recognize that investigation of the nature of the disease and the life history and habits of the insect are necessary preliminary steps. The practical problem is the control of the pest; the scientific study of its habits as a basis for control is research or investigation, and this will suggest many experiments, all directed toward a definite purpose and a part or extension of the investigation. But the man who starts in spraying with this and that, trying everything at hand without any basis for his cut-and-try efforts, is testing merely, and although he may hit upon a remedy, his work is in no sense investigation.

In feeding work the case is often on much the same plane. For example, we make a comparison of wheat bran and gluten meal for milk production. One of these feeds gives the better result, as measured by the yield and the financial returns, but often the inquiry stops there. If the question is merely a commercial one, the answer is sufficient, and the farmer can be advised. But we have added nothing to the sum of human knowledge, and we know no better how to feed next year if the relative prices have changed. Is a pound of digestible fat or of protein in one feed of the same value for making milk as that from another source? Or are there some particular constituents whose functions are especially important and give the feed a special value? The real physiological relation of these feeds, or of their respective constituents, to the elaboration of milk remains untouched by such experiments.

Suppose, again, we feed a lot of steers on heavy rations of corn for fattening. Humanity says shelter them in a warm, comfortable barn. They appear after a little to resent this. They are uncomfortable and it is difficult to keep them up to the high rations. Divide them into two lots, and turn one out into the cold with only a shed to shelter

them from the winter winds. The latter lot does better—is more thrifty, eats better, and makes better gains. Is the question answered? Too often it stops here. We have the empirical result, but it is supported by no reason.

Put one of these heavily fed steers into a respiration calorimeter and we find he gives off heat enough under his heavy corn feeding to keep his body warm without artificial protection. The reason has been found. Again, knowledge of common things has been made accurate and precise, and may be translated into action.

In pure science the accumulation of data has in itself often been the object, rather than merely a means to an end; while in experiment station work the case has often been reversed. Here in our haste we have sought mainly the result, without so much attention to accumulating extensive data for broad generalizations.

Research is worthy of the name only as it sets up definite ideals or aims which it strives to attain by scientific methods of procedure. This will involve a definite plan of operations, a thorough consideration of what is known of the subject and its bearings, both practical and scientific, and should lead the experimenter to learn something of the reasons for the results he secures. While the aim should remain fixed, the plan will often have to be modified in detail as the investigation progresses. But too often there appears to be lacking any well-thought-out plan or object; this is developed piecemeal and lacks in directness.

There are certain operations which will always be more or less experimental, as they will depend upon a variety of conditions, either indefinite in extent or combined in such a way as to make the outcome somewhat uncertain. Such operations can not proceed with mechanical exactness, and this very element of uncertainty will lend a charm to the work. But the object to be attained and the line of experiment should be matters of mature consideration. An investigation should presuppose this preliminary.

The line of demarcation between investigation and the lower grades of inquiry is not always clear and sharp, but the character of the problem does not determine this. The lowliest and most common subject may be a proper matter for real investigation. It is the man in charge of the work and his mental attitude toward it which determines whether it shall be a simple test, a conclusive experiment, or a thorough investigation. If he has none of the scientific spirit or sees only the purely practical phase, his work will stop with comparisons and simple experiments; but if he has the true spirit of the investigator and is trained to observe, even though he may not have seen a college class room, his results will contribute something toward establishing a scientific fact.

We have been accused in our experimental work of having the immediately practical results too constantly in mind. The immediately practical work is important and desirable. It has helped to make the American stations strong in the confidence of their constituents. It should be continued and the results carried to the farmer in demonstrations, cooperative experiments, and other popular ways. But it is equally important to get at the scientific facts, which have a wider and more permanent application. Surely there is no conflict between such investigation and the securing of practical results.

Already our station work is coming to assume a more national character. To a noticeable extent we are departing from the view that all work must have a decidedly local flavor or application. The community of interest is being recognized. It is seen that much of the research work has a wider field of usefulness. Its results are applicable in the main to a wide extent of country, and require only to be adapted to local conditions.

If the Adams Act leads us to think more clearly along these lines and to consider the strictly investigation problems which the practical experiments and experience are constantly suggesting, it will have a far-reaching effect and will materially stimulate the original research and investigation it contemplates.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The determination of available plant food in soil by the use of weak acid solvents, part 2, A. D. HALL and A. AMOS (*Jour. Chem. Soc. [London], 89 (1906), No. 520, pp. 205–222, figs. 3; abs. in Analyst, 31 (1906), No. 361, p. 129*).—The rate of solution of phosphates and the concentration of the extract obtained by continuous extraction of soil samples with water saturated with carbon dioxid and with 1 per cent citric-acid solution were studied in the investigations here reported and graphically represented. The general conclusions reached are summarized as follows:

"(1) The solvent does not at once remove all the phosphoric acid capable of going into solution in the particular solvent employed; instead an equilibrium is established between the phosphoric acid in the solvent and in the soil.

"(2) The concentration of the solution in equilibrium with the soil falls with each successive attack of the soil by the same solvent. This indicates the presence in the soil of several compounds of varying solubility, the mass of the more soluble being small and of the same order as the amounts going into solution in the earlier extracts. When these more soluble compounds have been removed, an approximate constant equilibrium is attained between the phosphoric acid remaining in the soil and that going into solution at each extraction, indicating that after the more soluble compounds have been removed there remains a phosphate in each soil of such low solubility that the amount going into solution at each extraction is independent of the mass present in the soil.

"(3) With soils which have been for many years manured with a particular phosphate, the amounts of phosphoric acid going into solution in successive extractions with 1 per cent citric-acid solution follow a logarithmic law of decrement, indicating the presence of one particular phosphate which dissolves in proportion to the mass of it present in the soil. This law does not, however, hold for ordinary soils which have been variously manured.

"(4) In the case of the Rothamsted soils, the sum of the phosphoric acid dissolved out by the first five extractions with citric acid approximates very closely to the known surplus of phosphoric acid accumulated by the additions of manure to the soil.

"(5) Assuming that the solvent actions of the soil water and of the weak acid solvents employed in the laboratory are comparable, the evidence lends no support to the theory that all soils give rise to a natural soil solution of approximately constant composition, which is not disturbed by the use of fertilizers containing phosphoric acid.

"(6) For the practical purposes of soil analysis, the evidence afforded by a single extraction of the soil for 20 hours with continual shaking is very similar to that obtained from a series of successive extractions by the same solvent, and leads to the same conclusions as to the manurial requirements of the soil."

On the determination of phosphoric acid as magnesium-ammonium phosphate and as ammonium phosphomolybdate, G. JÖRGENSEN (*K. Danske Vidensk. Selsk. Skr., 7. ser., 2 (1905), No. 4, pp. 141–238, figs. 3; abs. in Chem. Ztg., 29 (1905), No. 96, Repert. No. 23, p. 342*).—The author critically reviews the literature of this

subject and reports detailed studies of the conditions affecting the accuracy of the magnesium, molybdomagnesium, molybdic, and citrate methods.

He concludes that either gravimetric or volumetric methods depending upon a constant relation of phosphorus to molybdenum in ammonium phosphomolybdate are not reliable because the composition of the precipitate varies with the conditions of precipitation. The proportion of phosphorus to nitrogen in the ammonium phosphomolybdate is also much too variable to serve as a means of determining phosphoric acid. The solubility of magnesium-ammonium phosphate in ammoniacal water can be determined with reasonable accuracy even when ammonium chlorid, ammonium citrate, as well as magnesium chlorid are present. The equilibrium between magnesium chlorid, ammonium chlorid, and ammonia at about 100° C. can be determined with sufficient accuracy.

In the precipitation of phosphoric acid by means of magnesia mixture in cold solution it is not possible to obtain a precipitate of constant composition either by direct precipitation or by the use of the molybdic or citrate methods. By precipitation in hot solution the conditions of precipitation may be varied considerably without any variation in the proportion of phosphorus to magnesium, and in this way 1 part of phosphoric acid in 1,000 parts of solution may be determined with accuracy.

The molybdomagnesium method worked out by the author on this basis gives accurate results even in the presence of large amounts of strong inorganic acids, silicic acid, and citric acid, as well as of calcium, iron, and aluminum compounds. The citrate method which he proposes, however, is not applicable in case of solutions containing a large amount of silicic acid and can be used with safety only when small amounts of calcium, iron, and aluminum compounds are present. The molybdomagnesium method gives highly accurate results with fertilizers and crude phosphates. The citrate method is recommended only for the determination of water-soluble phosphoric acid in superphosphates.

The molybdomagnesium method proposed is in brief as follows: The solution of phosphate is heated for 10 minutes to about 50° C., shaken, and allowed to cool. A slight excess of molybdic solution is added (formulas for the calculation of the amount of molybdic solution to be used are given), the precipitation and collection and washing of the precipitate being done in the usual way. The precipitate is dissolved in the smallest possible amount of 2.5 per cent ammonia solution, and the solution is heated nearly to the boiling point when neutral magnesia mixture is added drop by drop to precipitate the phosphoric acid. While the solution is cooling it is frequently shaken in order to cause the formation of a crystalline precipitate. After standing 4 hours the precipitate is collected on a filter, ignited, and weighed as usual.

In the citrate method proposed the phosphate solution is mixed with 25 to 30 cc. of neutral ammonium citrate and 25 cc. of 10 per cent ammonia solution, heated to boiling in a covered flask, and the phosphoric acid precipitated with 30 to 40 cc. of neutral magnesia mixture. By repeated stirring or shaking the precipitate separates in crystalline form, and after standing at least 4 hours is collected on a filter, ignited, and weighed as usual.

A list of 269 references to literature of this subject is given.

Citrate solubility of phosphoric acid in fertilizers, J. K. S. Dixon (*Jour. Agr. Sci., 1 (1906), No. 4, pp. 430–443*).—The author reports studies of the solubility of the phosphoric acid of steamed bones, raw bones, fish meals, and guano in alkaline, neutral, and acid ammonium citrate, and 0.1, 1, and 2 per cent citric acid. The results are somewhat inconclusive, but seem to warrant the following conclusions:

"(1) The order of the solvent power of the three solutions of each of the two classes remains the same throughout. In the citrate solutions the order is (descending), (a) neutral, (b) acid, (c) alkaline solution, with only two exceptions, viz., the

raw bone meals. . . . With the free acid the solubilities are in the order of the strength of solution without exception.

"(2) The presence of free ammonia in the citrate solution lowers the solubility and the amount of lowering varies with different products. . . .

"(3) Bones of similar chemical composition and physical properties, and containing practically the same percentage of total phosphoric acid, have different solubilities in the same citrate or citric-acid solution. . . . This observation leads one to infer (a) that the action of the solvent is either not one of simple solution, or (b) that there is a fundamental difference in the phosphates of the bones." The latter view is said to be in accord with that of Gebek (E. S. R., 6, p. 398).

The determination of phosphoric acid in Thomas slag, bone meal, etc., O. BÖTTCHER (*Chem. Ztg., 29 (1905), No. 100, pp. 1293, 1294; abs. in Chem. Centbl., 1906, I, No. 4, p. 282*).—The author summarizes data obtained in over 800 analyses of Thomas slag to show that his method of determining the citric-acid soluble phosphoric acid in Thomas slag (E. S. R., 15 p. 744) gives reliable results when carried out promptly and with proper precautions. Data are also reported to show that the German official method for determining total phosphoric acid in Thomas slag, bone meal, etc., gives reliable results and that it is not necessary, as claimed by Schenke, to neutralize the solution before precipitation, whether nitric acid or sulphuric acid has been used for preparing the solution of the phosphate.

Analytical notes on the superphosphate industry, L. SCHUCHT (*Ztschr. Angew. Chem., 19 (1906), pp. 183-187; abs. in Chem. Centbl., 1906, I, No. 11, pp. 870, 871; Bul Soc. Chim. Paris, 3. ser., 36 (1906), No. 5, p. 558; Analyst, 31 (1906), No. 361, p. 129*).—Drying at 100° C. for 3 hours gives inaccurate results for moisture. Better results were obtained by exhaustion of 2 gm. on the filter with absolute alcohol and ether and weighing the evaporated extract after heating to 120° for 3 hours and the residue on the filter after heating to 40° until the ether disappears.

The author defends his oxalate method of determining free acids against W. Möller's criticism that it gives too low results and is less accurate than the method of alkalimetric titration, reporting further tests which bear out his contention. He condemns the sugar inversion method. The examination of silico-fluorids by titration with one-half normal alkali and phenophthalein and methyl orange is discussed.

Use of the Heraeus electric crucible in the analysis of phosphates, F. HAUSSDING (*Chem. Ztg., 30 (1906), No. 7, pp. 60, 61; abs. in Bul. Soc. Chim. Paris, 3. ser., 36 (1906), No. 4, p. 430; Analyst, 31 (1906), No. 361, p. 128, fig. 1*).—A crucible is described with which it is possible with addition of magnesia to calcine organic phosphates in two minutes. The crucible is also useful for igniting ammonium-magnesium phosphate precipitates.

The industrial analysis of water, E. BOSCH (*Ztschr. Angew. Chem., 19 (1906), pp. 92-95; abs. in Bul. Soc. Chim. Paris, 3. ser., 36 (1906), No. 5, p. 555*).—The author discusses various methods of industrial analysis of water and proposes to test for presence of magnesium and sodium sulphate by adding barium carbonate and phenolphthalein and boiling, the production of a decided coloration indicating that the sulphuric acid is in part combined with magnesium and sodium and not entirely in form of calcium sulphate.

The determination of nitrous acid in water analysis, G. LUNGE (*Ztschr. Angew. Chem., 19 (1906), No. 7, p. 283*).—The author calls attention to the fact that some analysts have confused his method for the detection of nitrous acid in sulphuric acid with the colorimetric method proposed by him for the determination of nitrites in water.[a] In the latter case no sodium acetate is used with the "Lunge reagent" (a mixture of an acetic-acid solution of α-naphthylamin and a water solution of sulfanilic acid).

[a] Ztschr. Angew. Chem., 7 (1894), p. 348.

The separation of solutes from solvents by absorbing media, F. K. CAMERON and J. M. BELL (*Abs. in Science, n. ser., 23 (1906), No. 583, p. 324*).—This is an abstract of a paper presented at the New Orleans meeting of the American Association for the Advancement of Science.

A study of the absorption of dyes from water by blotting papers, cotton, and soil is reported, from which it is concluded that the capillary movements of solutes through absorbing media follow an empirical law—"$y^n=kt$, where y represents the distance through which the movement has taken place, t the time of movement, and n and k constants depending on the nature of the substances used, although n approximated 2.3 in most of the cases to which the formula has so far been applied." This formula holds, however, only when neither the distance nor time is large.

Chemistry of the proteids, G. MANN (*London and New York: The Macmillan Co., 1906, pp. XVIII + 606, dgms. 6*).—It has been the author's purpose to summarize, classify, and discuss the available data regarding the composition, structure, and characteristics of proteids, the principal topics dealt with being the reaction of albuminous substances, their dissociation products, the synthesis of albumins and their constitution, albumoses and peptones, salts of albumins, halogen albumins and allied matter, and physical properties and classification of albumins.

As the author points out, special stress has been laid on the proposition that cellular metabolism is a cyclic event and not a question of anabolism and catabolism, and throughout the volume the biological aspect of chemistry has been constantly kept in mind. The synthesis of albumins, as far as it was known up to September, 1905, is given in full. The carbohydrate radicals of proteids are dealt with fully because of their biological importance, and for the same reason special attention has been paid to sulphur.

A new view has been advanced, namely, that so-called neutral salts of albumins are in reality not neutral, for it is their very want of neutrality which allows them to dissolve in water, and which also enables them to dissolve globulins or to keep these compounds in solution.

The subject of autodigestion of nucleo-proteids has been considered at length, as it is believed that it will in the near future throw a great deal of light on the question of metabolism.

A purely chemical classification has been adopted for proteids, "the individual substances being arranged in such a way as to lead from the lower members of a series to the higher ones—from the less to the more highly oxidized forms—and from open chain to ring compounds."

A full index and a bibliography add to the value of the volume. The author states that his book is based on the second edition of O. Cohnheim's *Chemie der Eiweisskörper* (E. S. R., 16, p. 439), but that a large amount of additional matter has been included.

Practical elementary guide for the examination and analysis of milk, A. FARINES (*Guide pratique et elementaire pour l'examen et l'analyse des laits. Paris, 1905; rev. in Rev. Gén. Lait, 5 (1906), No. 13, p. 303*).—This work is based upon a course given in a dairy school and consists of practical methods for the examination of milk, the more rapid and simple methods being given the preference inasmuch as the book is designed not only for students in dairy courses but for practical dairymen.

Experiments with the "sin-acid" butyrometer, J. ADORJÁN (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 3, pp. 117-125*).—Comparative tests of the Sichler nonacid method and the Gerber method are reported, the author concluding that at present the nonacid method can not supplant the simpler and more rapid acid method of Gerber. It is considered probable, however, that with improvements the nonacid method may become of great practical importance.

Rapid analysis of butter, H. W. CHARLTON (*Dairy, 18 (1906), No. 208, p. 101*).—This method consists in separating the melted butter into two layers by means of a centrifuge and observing the volume of each layer at 100° C. The percentage by volume of the lower layer consisting of water, salt, and curd is considered practically the same for normal butter as the percentage of water by weight. With abnormal butter the method does not give the correct percentage of water by weight, but indicates, according to the author, that there is something wrong. The author states certain conditions that must be observed in the use of this method which is considered better than any partial gravimetric analysis for showing the relative value of butter samples.

Note on the method of silver indexes for the detection of cocoanut oil in butter, F. JEAN (*Ann. Chim. Analyt., 11 (1906), No. 4, pp. 121-124*).—The author's investigation leads him to conclude that the method of silver indexes (E. S. R., 17, p. 834) may confirm the presence of cocoanut oil in butter, but that negative results are not in all cases to be considered as invalidating results obtained by other methods, especially by the method of Muntz and Coudon (E. S. R., 15, p. 850) when the butter is adulterated with a mixture of different fats.

Microscopy of vegetable foods and condiments, J. MOELLER (*Mikroskopie der Nahrungs- und Genussmittel aus dem Pflanzenreiche. Berlin: Julius Springer, 1905, 2. ed., pp. 599, figs. 599; rev. in Österr. Chem. Ztg., 9 (1906), No. 5, p. 69*).—This volume, which describes the histological structure of foods and condiments of vegetable origin with a view to their identification under the miscroscope, has been thoroughly revised, and the author states that he has had the cooperation of A. L. Winton in the work.

The quantitative estimation of the lecithans, W. KOCH and H. S. WOODS (*Jour. Biol. Chem., 1 (1906), No. 2-3, pp. 203-211*).—Using methods which are described, lecithins and kephalins were determined in a number of samples of muscle of different sorts, submaxillary glands, pancreas glands, testicles, lung, kidney, liver, white and yolk of egg, mothers' milk, cows' milk, bread, etc.

The identification of horse and colt flesh by means of its glycogen content, M. MARTIN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 5, pp. 249-266*).—A comparison of different methods of estimating glycogen was undertaken with a view to devising a means of identifying horse flesh in sausage and other food products, and a number of determinations of the glycogen content of different sorts of flesh were made. According to the author, horse flesh in sausage may be detected by determining the glycogen content, and Pflüger's method is best suited for the purpose.

Sulphate and sulphur determinations, O. FOLIN (*Jour. Biol. Chem., 1 (1906), No. 2-3, pp. 131-159*).—Methods of determining sulphur were studied and modifications and precautions suggested which the author considers necessary to insure accuracy, the investigations as a whole being carried on with reference to the determination of different sorts of sulphur in urine.

The method for determining inorganic sulphates is as follows: Add 5 per cent barium-chlorid solution, drop by drop, preferably by means of an automatic dropper, to 25 cc. of urine diluted with about 100 cc. of water and acidulated with 10 cc. of dilute hydrochloric acid. The solution must not be shaken, stirred, or otherwise disturbed while the barium chlorid is being added. At the end of an hour or later shake and filter through a Gooch crucible. Wash the precipitate with about 250 cc. of cold water, dry, and ignite.

Methods are also given for total sulphates, ethereal sulphates, and total sulphur.

Bluestone and formalin, T. MACFARLANE (*Lab. Inland Rev. Dept. [Canada] Bul. 115, pp. 6*).—Analyses of 23 samples of copper sulphate and 11 of formalin are reported Six of the samples of copper sulphate were adulterated or inferior in quality and 1 sample of formalin showed only 25.6 per cent of formaldehyde.

The interpretations of chemical analyses for farmers, H. Ingle (*Transvaal Agr. Jour., 4 (1906), No. 14, pp. 330-357*).—The object of this article is "to explain, in as popular a manner as possible, the practical meaning of analyses of some of the more important substances produced or consumed in agriculture." The main topics discussed are soils, manures, feeding stuffs, and antiseptics.

Agricultural chemistry during the second half of the year 1905, W. Zielstorff (*Chem. Ztschr., 5 (1906), Nos. 4, pp. 73-75; 5, pp. 99-101; 6, pp. 123, 124*).—Brief reviews are given of articles relating to the nutrition of plants and animals.

Thirteenth annual report of the committee on atomic weights. Determinations published in 1905, F. W. Clarke (*Jour. Amer. Chem. Soc., 28 (1906), No. 3, pp. 293-315*).

METEOROLOGY—WATER.

Outlines of tropical climatology, G. M. Giles (*Climate and Health in Hot Countries. London: John Bale, Sons & Danielsson, Ltd., 1904, pt. 2, pp. 109*).—This article discusses the general characteristics of tropical climates, and the more important data determining the character of such climates, including temperature (mean and range), relative humidity, amount and distribution of rainfall, cloudiness, and amount, daily distribution, and direction of the wind, and summarizes all available data bearing upon the special characteristics of the climate of the countries lying in the Mediterranean Basin, including Algeria, Malta, Cyprus, and Egypt; other regions of the African Continent, including Soudan, Abyssinia, region of the Great Lakes, Kongo Basin, West Coast, Sierra Leone, Gulf of Guinea, East Coast, Madagascar, Mauritius, Red Sea and its coasts including Somaliland; the Asiatic Continent, including Palestine, Persian Gulf region, Arabian Peninsula, India and Ceylon, Indo-Malay Peninsula, Straits Settlements, Siam, Cochin China, China, Malay Archipelago; Australia, Pacific Islands, the Southern United States, Mexico, Central America and the Isthmus of Panama, West Indies, Bermuda, Madeira, and various places in South America.

Monthly Weather Review (*Mo. Weather Rev., 33 (1905), Nos. 12, pp. 515-570, figs. 8, charts 11; 13, pp. XV+571-591, charts 8*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the month of December, 1905, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., No. 12 contains special contributions on Doctor Margules on the Energy of Storms, by S. T. Tamura; Air and Water Temperatures, by W. F. Cooper; International Meteorological Definitions and Symbols, by E. R. Miller; Deposit of Ice Columns (illus.), by E. R. Miller; The Climate of Madison, Wis. (illus.), by J. L. Bartlett (see p. 941); Tornado Insurance (illus.), by H. E. Simpson; Norway's Contributions to the Natural Sciences, by R. S. N. Sartz; and A Visit to European Observatories, by G. J. O'Connor; and notes on the mild weather of December, 1905, meteorology in India, meteorological maps for school use, Thomas R. Rodman, meteorology in Holland, a large meteor, Weather Bureau men as instructors, special meteorological stations for special studies, and cyclones and anticyclones.

No. 13 contains a table of contents, list of corrections, additions, and changes, and an index for volume 33; a report of the Forecast Division; report of the Chief of the Weather Bureau for the fiscal year ended June 30, 1905; and a summary of observations on pressure, temperature, precipitation, humidity, cloudiness, and other meteorological phenomena "based essentially upon data received from about 166 regular Weather Bureau stations, 33 regular Canadian stations, and from such climate and crop sections as have forwarded their annual summaries in time."

The mean pressure of air departed considerably from the normal during the year, being "below the normal in Maine, Vermont, northern New Hampshire, extreme eastern Massachusetts, the Peninsula of Florida, the western portions of the southern

and middle Plateau and southwestern portions of the northern Plateau regions, and the south and middle Pacific and southern portion of the north Pacific districts; elsewhere it was above the normal. . . . The mean temperature was above the normal in the Florida Peninsula, upper Lake region, North Dakota, Missouri Valley, and the northern slope, northern Plateau, and Pacific regions; elsewhere it was below the normal." The departures in temperature were as a rule small and "in but few instances exceeded 1°, the greatest, +2.5°, occurred over the Red River of the North Valley. . . . Over the country east of the Mississippi River the distribution of precipitation was not well marked as to geographic districts, as excesses and deficiencies of considerable amount occurred in the same district. To the westward of the Mississippi River the lines of demarcation between the excesses and deficiencies were much better defined as to geographical districts. Considering the geographic districts as a whole the precipitation for the year was above the normal in the Florida Peninsula, Gulf States, Missouri Valley, slope and southern and middle Plateau and south Pacific regions; elsewhere it was below the normal."

Summary of meteorological observations, January to June, 1904, F. H. LOUD (*Colo. Col. Studies, 11 (1904), Sci. Ser. Nos. 33-35, pp. 54-76*).—The equipment of Colorado College for meteorological observations is described, the methods of reduction are explained, and observations on temperature, pressure, precipitation, humidity, sunshine, and wind movement are reported.

Determination of number of hours of possible sunshine at Colorado Springs, F. H. LOUD (*Colo. Col. Studies, 11 (1904), Sci. Ser. Nos. 33-35, pp. 77-82*).—A description of the method used in making the determination and the results obtained in 1888 are reprinted from an earlier publication (Colorado Weather, April, 1889).

Meteorology for the year 1905, J. DERÔME (*Rev. Sci. [Paris], 5. ser., 5 (1906), No. 2, p. 53*).—This a brief summary of observations at Paris on atmospheric pressure, temperature, and rainfall compared with similar observations for 1903 and 1904. The characteristic feature of the weather in the region of Paris during the year was excessive rainfall. The rainfall at Park St. Maur was 641.1 mm. in 1905 as against 541 mm. in 1903 and 527 in 1904, the mean for 1841-1890 being 594 mm. There were 169 rainy days in 1905, as against 159 in 1903 and 141 in 1904. The wettest month was June, 108 mm. The heaviest daily rainfall, 27.2 mm., occurred August 28.

The mean temperature of the year was 9.87° C., being lower than that of 1903 (10.38°) and 1904 (10.4°). The mean temperature for the period 1841-1890 was 9.93°. The highest temperature observed in 1905 was 32° C., the lowest −10.9°.

The mean annual pressure was 758.97 mm. The normal for the period 1841-1890 was 757.6. The lowest barometer observed in 1905 was 730.3 mm., the highest 782.1.

Meteorological summary for 1905, H. DUFOUR and D. VALET (*Chron. Agr. Vaud, 19 (1906), No. 3, pp. 49-54*).—Observations at Lausanne on temperature, precipitation, sunshine, temperature of the soil, and general weather conditions are briefly summarized for the year and compared with averages for previous years and neighboring places.

Practical meteorological studies and comparative observations at the stations of Beaulieu, Sevres, and Vacquey for the year 1903, G. EIFFEL (*Études pratiques de météorologie et observations comparées des stations de Beaulieu, Sèvres et Vacquey pour l'année 1903. Paris: L. Maretheux, 1905, pp. 377; rev. in Rev. Gén. Sci., 17 (1906), No. 3, p. 149*).

Meteorological observations, G. GINESTOUS (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 37, pp. 590-614*).—Tabular summaries are given of observations, June to November, 1905, at a number of places in different parts of Tunis on precipitation, temperature, atmospheric pressure, humidity, evaporation, cloudiness, direction of the wind, and casual phenomena. A brief account is also given of meteor

ological observations made in Tunis during the eclipse of the sun August 30, 1905. These relate to temperature, relative humidity, wind movement, cloudiness, etc.

Meteorological Chart of the Great Lakes, A. J. HENRY and N. B. CONGER (*U. S. Dept. Agr., Weather Bur., Met. Chart Great Lakes, 1905, No. 2, pp. 12, chart 1*).—This is a summary of observations on storms and high winds over the lake region, 1905; precipitation and lake levels, November, 1904, to October, 1905; opening and closing of navigation, 1905; vessel passages at Detroit, Mich., during the season of navigation; and wrecks and casualties during 1905.

Climate of the Pacific coast, A. MCADIE (*Outing Mag., 47 (1906), No. 5, pp. 555–558*).—The more characteristic features of temperature, rainfall and snowfall, sunshine and evaporation are discussed and compared with similar climatic features of the Atlantic coast. It is shown that the temperature is less variable throughout the year on the Pacific coast than on the Atlantic coast, although, owing to the topography of the country, wide differences of temperature occur within short distances.

"The orography of the Pacific coast is different from that of the Atlantic. The mountains stand in great ranges, inclosing many valleys running as a rule parallel to the coast. The angle of inclination of the mountains to the rain-bearing winds is favorable for heavy rainfall, north of the thirty-fifth parallel. In southern California the mountains trend east and west, and much drier weather is the rule. While the inclination of the mountains is an important factor in rain production, the chief factor, of course, is the movement of the air due to the great pressure areas."

The heaviest rainfall in the country occurs on the north Pacific coast; the least in southeastern California, varying in 1904 from nothing in the latter region to 145 in. in eastern Oregon. Due to the influence of the mountains the snowfall is heavier in many parts of the Pacific coast than in most portions of Canada, varying from a trace in San Francisco to 360 in. at Fordyce.

"Evaporation data are scant, but it is likely that the highest rate of evaporation in our country will be found in California. At Calexico, from July 1, 1903, to July 1, 1904, the evaporation measured 108 in., i. e., 2,743 mm., or over 7 mm. per day."

The Pacific coast is thus shown to be a region of climatic contrasts and contradictions. The mountains favor diversity of climate and give rise to many so-called "local" climates.

The climate of Madison, Wis., J. L. BARTLETT (*Mo. Weather Rev., 33 (1905), No. 12, pp. 527–534, figs. 6*).—Meteorological observations at Madison, beginning as early as January, 1853, are summarized, and from them the climatic characteristics of the place are deduced (see also E. S. R., 17, p. 224).

As regards the general climatic situation, it is stated that "southern Wisconsin enjoys a type of climate peculiar to continental interiors, characterized by great extremes of temperature. As it lies on the windward side of Lake Michigan, its atmospheric conditions are but slightly influenced by the Great Lakes. In general this is a region of warm summers, with occasional periods of extreme heat, which may be interrupted by destructive local storms. The winters are somewhat cold and stormy, with frequent cold waves. The rainfall is sufficient for raising excellent crops, and is heaviest during the spring and early summer and least in the winter. About 50 per cent of the possible duration of sunshine is recorded at the surface of the earth."

Madison occupies a narrow strip of land lying directly between Lakes Mendota (15 square miles in area) and Monona (5 square miles in area), and "the tendency of the lakes is to lower the mean maximum temperatures throughout the year, to raise the mean minimum, and thus to decrease the mean daily range. . . . The average date of last killing spring frosts is April 21, and the earliest in the fall October 17. Comparing these dates for a number of years with the dates of similar

phenomena at Harvey, Wis., which is directly east of Madison, away from any small lakes, but nearer Lake Michigan, it is found that at Harvey killing frosts occur, as a rule, two weeks later in the spring and two weeks earlier in the fall. Thus the growing season is lengthened about one month at Madison, apparently by the influence of the presence of lakes Mendota and Monona."

The average annual rainfall during 36 years has been about 37 inches. "Dry spells are of almost annual occurrence at Madison, and occasionally pronounced droughts occur."

"The prevailing winds vary from northwest during November–March, to south during the remainder of the year. These two directions prevail nearly equally."

A first report on the relations between climates and crops, C. ABBE (*U. S. Dept. Agr., Weather Bur. Bul. 36, pp. 386*).—This bulletin summarizes the views of investigators and observers on this subject which had been published up to 1891. Numerous extracts from the more important contributions to the subject are included. "The work is prepared with the idea that it will be especially useful to the teachers of the agricultural colleges and the investigators of the agricultural experiment stations."

The subject is presented from three points of view: (1) Physiological, including results of studies such as those of Sachs and other physiological botanists; (2) experimental, including results obtained by the methods pursued by agricultural experiment stations, and botanical and biological laboratories; and (3) statistical, embodying the results obtained by "comparing the statistics of the successive annual harvests in the country at large with the statistics of the prevailing climatic conditions."

The bulletin is divided into four parts as follows: (1) Laboratory work, physiological and experimental, (2) open air work—experience in natural climates, (3) statistical farm work, and (4) authorities.

The author emphasizes especially "the importance of a climatic laboratory and the methods that must be pursued in order to evolve new varieties of crop plants adapted to special climatic conditions."

It is said that "a continuation of this study, bringing the subject up to date, is contemplated."

Weather forecast, D. E. HUTCHINS (*Rev. in Agr. Jour. Cape Good Hope, 28 (1906), No. 1, pp. 98-105*).—This is a review of a paper by Mr. Hutchins and its discussion before the South African Philosophical Society on long-period forecasts and of the various cycles on which they are based, namely, (1) the sunspot or solar cycle of 11.11 years; (2) a cycle, with alternating periods of 9 and 10 years, termed the storm cycle; and (3) a cycle with alternating periods of 12 and 13 years, termed Meldrum cycle.

The author's conclusions with regard to the application of these cycles in weather forecasting are as follows: "(1) The three main weather cycles are of general application throughout South Africa. I had considered in 1888 that the storm cycle brought practically no rain to the eastern stations, and Meldrum's cycle little or no rain to western stations. The experience of the last 17 years shows that both may extend east and west beyond their area of greatest influence. (2) Observations from the northern stations are as yet too short to draw safe conclusions, but they seem to indicate that the pulse of heavier rainfall occurs a season earlier at northern stations (Transvaal and Rhodesia). (3) There are obscure indications of a tendency to rain at the sunspot minimum, and possibly the irregular rain of 1902 may be accounted for as a sunspot minimum rain. It so happens that the normal sunspot minimum periods (11-22-33-44-55.5-67-78-89-100 in each century) have since the year 1841 so frequently coincided with other cycles that the exact influence of the sunspot minimum is difficult to trace. In the long chain of the Royal Observatory rainfall figures, the sunspot minimum has had no practical influence till we get to the doubtful case of the 1902 rains. At other stations sunspot minimum rains are more clearly traceable.

Note the rains of 1866 at Durban, of 1900 at Bulawayo, Salisbury, and Johannesburg. Further observations are necessary before it can be stated what is the exact influence of the sunspot minimum on South African weather. (4) Up to the present, the direct influence of Brückner's 35-year cycle is inappreciable in South African weather."

Forecasts for the year 1906, based on the weather cycles, are given.

The atmosphere, G. BLEUEL (*Jahresber. Agr. Chem., 3. ser., 7 (1904), pp. 3-18*).—A review is given of literature relating to this subject published during 1904, classified as follows: Constituents (chemistry) of the atmosphere and of atmospheric precipitation, and physics of the atmosphere (meteorology).

Water, A. HEBEBRAND (*Jahresber. Agr. Chem., 3. ser., 7 (1904), pp. 18-25*).—A review is given of the literature relating to this subject published during 1904, classified as follows: Spring, drain, and irrigation water, and sewage and the purification of sewage waters.

A method of determining the turbidity of water, J. F. LIVERSEEGE (*Jour. Soc. Chem. Indus., 25 (1906), No. 2, p. 45*).—A method based upon the ability to read standard type of different sizes through a column of water 2 ft. long at a distance of 2½ ft. is described, the results being termed "turbidity expressed in feet of distance to read standard type."

On the Wartha method for determining hardness in water, H. SICHLING (*Deut. Gerber Ztg., 1905, pp. 271-276; abs. in Chem. Centbl., 1905, II, No. 13, pp. 982, 983*).—The author concludes from his studies of various methods that Wartha's method is simple, easy of execution, and of value especially for tannery chemists. It was preferable to Clark's method in cases in which the use of soap solutions presented difficulties. It must, however, be used with great care in waters naturally containing soda or which have been softened by the use of this substance.

Notes on investigations relating to rain water, H. M. KNIPSCHEER (*Pharm. Weekbl., 42 (1905), pp. 1042-1045; abs. in Chem. Centbl., 1906, I, No. 5, p. 395*).—The author refers to investigations by Nonhebel on the importance of chlorin in rain water, and describes a simple method, using fluorescin, of determining the depth to which rain water sinks into the soil.

The disappearance of water from the upper layers of the soil, W. GÖTZ (*Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 3, pp. 391-419*).—A general discussion is given of reduction of humidity due to removal of forests, disappearance of bodies of water, and increased percolation, and of the sources of the supply of water in the soil.

Influence of forests on underground waters, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 10 (1905), No. 49, pp. 721-723, figs. 3*).—The effect of forests in lowering the level of phreatic waters and in conserving moisture and regulating streams is briefly discussed.

The drinking water question (*Het Drinkwatervraagstuk. 1905, pp. 30, pls. 5*).—This is an account of a discussion of this subject at the Flemish Congress of Natural Science and Hygiene held at Aalst September 23 and 24, 1905, including articles by A. J. J. Vandevelde on Spring Water as a Source of Supply for Cities, and by I. Bauwens on Sanitary Examinations of the Water of a Number of Springs, with general discussion of the subject.

The hygienic rôle of germs in water, F. MALMÉJAC (*Rev. Sci. [Paris], 5. ser., 5 (1906), No. 6, pp. 176-178*).—The author concludes that a water containing a large number of saprophytic germs is as a rule badly filtered and protected and should not be used for drinking purposes. The same is true for waters containing a considerable number of *Bacillus coli communis*, and of course for all waters containing germs which are undoubtedly pathogenic.

The present status of waste water purification by biological methods, THUMM (*Österr. Ungar. Ztschr. Zuckerindus. u. Landw., 1905, No. 5; abs. in Centbl. Bakt. [etc.], 2. Abt., 15 (1906), No. 24, pp. 762, 763*).—A general review of this subject, especially as affecting England and Germany.

Effect of copper sulphate on the bacteriological and chemical constituents of large bodies of water, W. R. STOKES and J. B. THOMAS (*Amer. Med., 10 (1905), No. 26, pp. 1075-1078, fig. 1*).—The results of a limited number of experiments with copper sulphate on a swimming tank in Baltimore filled from the general water supply of the city are reported, from which "it would seem that in fairly pure water a dilution of 1 to 100,000 can be depended upon greatly to reduce the algæ and fermentative bacteria, and also clear the water by precipitating the matter in suspension. In moderately polluted water the fermentative bacteria are not destroyed."

SOILS—FERTILIZERS.

Renovation of worn-out soils, W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul. 245, pp. 16*).—The principal lessons which this bulletin is intended to enforce are briefly summarized as follows: "To build up and maintain fertility in the soil, feed a large part of the crops, and return the manure to the land. If manure is not available, plow under crops grown for the purpose. Plow deep (but do not subsoil). Grow leguminous crops for the nitrogen they add to the soil.

"Commercial fertilizers and lime may be important means of improving the soil, but the fertilizer requirements of different soils and different crops in different seasons are so little understood that we are not yet in a position to make positive recommendations that are of general application."

Present definitions of soil fertility, W. H. JORDAN (*Agr. of Mass., 1904, pp. 121-155*).—This paper discusses the various theories of soil fertility, particularly those advanced in Bulletin 22 of the Bureau of Soils of this Department. The author's views with reference to methods of soil management necessary to maintain fertility are summarized as follows:

"(1) Thorough tillage, with efficient machinery, to be given if possible when the moisture conditions of the soil admit of satisfactory pulverization.

"(2) Frequent surface tillage at times of scanty rainfall, in order to conserve the supply of soil moisture.

"(3) A sufficiently rapid rotation of crops to insure good soil texture, to allow the necessary frequency of applying fertilizing material, and as a main result to secure a paying stand of crops.

"(4) The introduction into the soil at frequent intervals of an amount of organic matter necessary to proper soil texture and water-holding power, either by application of farm manures, by plowing under soiling crops, or by the rotting of the turf.

"(5) The scrupulous saving of all the excrement of farm animals, both solid and liquid.

"(6) The purchase of plant food with due reference to the needs of the farm and to the system of farm management prevailing.

"(7) The maintenance in the soil of those conditions of drainage and aeration which promote the growth of desirable soil organisms, and the introduction into the soil, when necessary, of such organisms as are essential to the growth of particular plants."

The analysis of soils, E. A. MANN (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 2, pp. 141-144*).—The value of soil analysis for determining the fertility of soils, especially Dyer's method of determining availability of soil constituents, is briefly discussed. Studies which have been made indicate that the chemical methods are of value in case of West Australian soils.

Fertility studies on Wooster soil, A. H. SNYDER and C. L. COOK (*Ohio Sta. Bul. 167, pp. 85-119*).—An account is given in this bulletin of experiments made by the Bureau of Soils, cooperating with the Ohio Station, "to determine whether the results obtained by its wire-basket and aqueous-extract methods of studying the productiveness and manurial requirements of soils [E. S. R., 17, p. 227] were in accord with

those secured through plat experiments." The character of the soil, which is that of the 5-year rotation plats at Wooster, is described (E. S. R., 16, p. 752) and its previous history and treatment is explained.

A series of experiments with wheat in wire baskets to determine the effect of manures, fertilizers, and lime, and to study the effect of increasing (adding sulphuric and tartaric acids) or neutralizing (with sodium carbonate and hydroxid as well as with lime) the natural acidity of the soil is reported.

Cultures with the soil extract are reported in which the attempt was made "to determine whether or not the causes of a lowered productiveness are transmitted to the aqueous extract, and if so, whether these can be corrected by the various treatments found to be effective in the soil itself."

The results obtained by the above methods are compared with those obtained in plat experiments with like fertilizer treatment in a 5-year rotation on the same soil. The results are thus summarized:

"The experiments carried on . . . . during 11 years by the plot method and those carried on during the last 6 months by the culture methods of soil in wire baskets and of soil extract in bottles, agree in showing that the best results which have been obtained are those following the application of nitrate of soda in combination with acid phosphate, the application of lime or the application of manure. Being submitted to a five-crop rotation, this soil soon responds markedly to applications of phosphoric acid, and the effect of the continued application of this fertilizer is undoubtedly cumulative, this point being brought out equally well by both field and culture methods.

"Additional conclusions brought out by the basket and bottle cultures are as follows:

"(1) The character of the soil, as far as its ability to produce plants is concerned, is transmitted to its extract, as is shown by the fact that the same results may be obtained by growing plants in the extract as are obtained by growing them in the soil itself.

"(2) The soil is acid, probably with an organic acid, but its present low productivity is not due to the acidity.

"(3) The beneficial effect of lime is probably due in great measure at least to other causes than its power to neutralize the soil acidity.

"(4) The evidence points strongly to the conclusion that this soil contains some toxic materials somewhat similar to, but still differing in some of their properties from, those found in the Takoma lawn soil investigated by the Bureau of Soils of the U. S. Department of Agriculture [E. S. R., 17, p. 340]. It seems probable that the effect of lime on Wooster soil is largely due to its action, in some way as yet undetermined, upon these toxic bodies, and it may be that a large part of the effect produced by fertilizers and stable manure is due to some similar action on the part of these latter substances."

In his comments upon the general results, Director Thorne says: "The outcome of this work has been that results obtained in two or three weeks' time are in general agreement with field tests which required an entire season for their execution." He adds further, however, that "no single season's field work on a particular soil is a sufficient basis on which to formulate a definite prescription for the fertilization of that soil, and it is highly probable that we shall find the same law holding good in the conduct of the [wire-basket] method of investigation . . . . All that can be said of this method at present—and this is much—is that it promises to be a very useful help in one of the most intricate lines of investigation science has yet undertaken—that of the maintenance of soil fertility."

Fertility studies on Strongsville soil, A. H. SNYDER and C. L. COOK (*Ohio Sta. Bul. 168, pp. 119-138*).—The experiments reported in this bulletin were similar in plan and purpose to those with Wooster soil noted above, the experiments being

confined, however, to tests with the wire-basket method. The results obtained with the heavy clay Strongsville soil are thus summarized:

"(1) The soil has been greatly improved by placing it in good physical condition such as is obtained in potting.

"(2) The soil is naturally fertile so far as plant food is concerned, as shown not only by the basket cultures but as indicated by the result of the chemical analyses reported in Bulletin 150 of the Ohio Agricultural Experiment Station.

"(3) The effect of replanting the untreated soil in pots with wheat immediately after a crop of wheat has been grown in the same is to reduce the growth of plants approximately 50 per cent.

"(4) Lime appears to have some beneficial effect in the baskets. Heavier applications than the results in the baskets would seem to indicate have been found practicable in the field, probably owing to the physical effect which this substance has upon the soil.

"(5) No appreciable difference is detected between the results obtained with ground quicklime and hydrated lime.

"(6) Little if any beneficial effect has been shown from the application of mineral fertilizer salt to this soil after it has been placed in good physical condition, although an application of these salts, especially acid phosphate, gives a decided increase when the soil is in the condition found in the field.

"(7) Manure produces a small increase in the growth of plants in pots but not as great an increase as is secured from its application in the field. This is probably due to the fact that in the field its effect is mainly due to its physical action.

"(8) The effect of green manure is negative upon the crop planted immediately after it was applied, but gives a large increase in crops planted subsequently."

The conclusions drawn from these results are as follows:

"(1) The soil of the Strongsville test farm is sufficiently rich in the mineral constituents of fertility for abundant crop production, but such is not secured on account of the unfavorable physical condition of the soil.

"(2) An improvement of the physical condition of the soil, such as is obtained in the process of potting, or by the application of lime, barnyard manure, or green manure, gives a marked increase in the growth of the plants and apparently, to a great measure, obviates the need of the addition of mineral fertilizers."

Rubber soils, H. N. Ridley (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 10, pp. 388, 389*).—This is a brief note on a circular issued by the Royal Botanic Gardens, Ceylon, which gives a series of analyses of soils and of fresh and decaying leaves, twigs, etc., of the Para rubber plant. These analyses show that in sweeping off the ground 10,000 lbs. of fallen leaves and twigs, about 58 lbs. of lime, 36 lbs. of magnesia, 22 lbs. of potash, and 12 lbs. of phosphoric acid are lost to the soil.

Behavior of "soluble" phosphoric acid and its movements in the soil, W. Hoffmeister (*Das Verhalten der "löslichen" Phosphorsäure und ihre Wanderung im Boden. Insterburg: Bittnersche Druckerei, 1904; rev. in Centbl. Agr. Chem., 34 (1905), pp. 817–820; Jour. Chem. Soc. [London], 90 (1906), No. 520, II, p. 120*).—The results of 5 years' pot experiments on this subject are reported. Solubility in ammonium humate was used as a means of tracing the variations in the amount and distribution of the assimilable phosphoric acid at different periods.

The results indicate that long continued culture did not completely exhaust phosphoric acid soluble in ammonium humate. The reduction in the amount of such phosphoric acid was apparently due to withdrawal by crops and not to reversion to insoluble forms. Notwithstanding the constant removal of phosphoric acid from the subsoil, the relative amount of soluble phosphoric acid was found to increase from the surface downward, indicating a downward movement of the phosphoric acid in the soil.

Studies of the effect of heating the soil on the solubility of the phosphoric acid showed that samples of peat which in their natural condition did not contain determinable amounts of phosphoric acid soluble in ammonium humate yielded 0.006 to 0.061 per cent when heated at 160° C.

The removal of soluble salts from soils, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 11 (1906), No. 6, pp. 174, 175*).—Methods of flooding and drainage employed for this purpose in Egypt are briefly described.

Progressive changes in soil moisture, W. GÖTZ (*Met. Ztschr., 23 (1906), No. 1, pp. 14–24*).—It is maintained in this article that in the course of centuries there has been a progressive draining away of the moisture from the upper layers of the soil, especially of the higher lands, a reduction of the humidity of the air, and consequent increase in temperature variations between seasons and between night and day.

Underground studies, C. OCHSENIUS (*Helios, 22 (1905), pp. 37–66*).—Accounts are here given of studies of underground conditions in the region of Venice and of Frankfurt, the first with especial reference to the sinking of the soil, resulting in the fall of the Campanile, and the second with reference to the occurrence of salt deposits. The order of occurrence of the salt deposits (especially potash salts) under Frankfurt, their extent, composition, and uses, are discussed.

Soil physics laboratory guide, W. H. STEVENSON and I. O. SCHAUB (*New York: Orange Judd Co., 1905, pp. 80, pl. 1, figs. 16*).—This book, which is the outgrowth of the laboratory instruction given at the Iowa Agricultural College, is designed "to present to the instructor and the student a carefully outlined series of experiments in soil physics." It includes a series of 40 exercises accompanied by questions on various features of the experiments outlined.

"An earnest effort has been made to outline the exercises briefly and clearly in order that the student may proceed with the work without loss of time and without confusion. The exercises are also listed in a logical order with reference to their relation to each other and the skill required on the part of the student." The book is an extension of a pamphlet on the same subject issued by the department of agronomy of the Iowa Agricultural College. It meets in a very satisfactory manner a widespread and growing demand for a simple text-book on the subject.

Economic geology of the United States, H. RIES (*New York and London: The Macmillan Co., 1905, pp. XXI+435, pls. 25, figs. 97*).—It is stated that this work covers essentially the ground which is gone over in the elementary course in this subject at Cornell University, and it is hoped that it will prove useful as a text-book in other colleges. The arrangement differs from that of other books on the same subject in that the nonmetallic minerals are discussed first and the metallic minerals last, the reason for this being that the non-metallic minerals are much more important and valuable than the metallic and because it leads from a discussion of the simpler to the more complex forms of mineral deposits.

The book contains chapters on coal; petroleum, natural gas, and other hydrocarbons; building stones; clay; lime and calcareous cements; salines; gypsum; fertilizers; abrasives; minor minerals; water; soils and road materials; ore deposits; iron; copper; lead and zinc; gold and silver; silver-lead; aluminum, manganese, and mercury; and minor metals. At the end of each chapter there is a selected list of papers relating to the subject discussed.

The statistical data are drawn mainly from the reports of the U. S. Geological Survey. The chapter on fertilizers deals with the occurrence, nature, and uses of phosphates, guano, and greensand. The chapter on soils and road materials discusses the origin and properties of soils, especially residual and transported soils, and the distribution of soils in the United States, and very briefly considers the various available road materials in the United States.

Nitrification of nitrogenous matter in the soil, G. MASONI (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 1 (1904), No. 2–3, pp. 265–269; abs. in Centbl. Bakt. [etc.],*

2. Abt., *15* (*1906*), *No. 21*, *p. 643*).—Experiments with poudrette are reported which show that nitrification went on rapidly at first, but that later when the soil became drier and warmer denitrification set up. The bacteriological side of the question is not considered, but the relation of the use of poudrette to the development of smut in corn is discussed.

A study of nitrification of some organic fertilizers, GUILLIN (*Bul. Soc. Nat. Agr. France, 66* (*1906*), *No. 1*, *pp. 85–94*, *fig. 1*).—Studies of relative rate of nitrification in soil and comparative fertilizing value in pot experiments with oats are reported for dried blood, wool waste, roasted wool, crude ammonia obtained from evaporation of ammoniacal gas liquor, wine lees, and "galalith," a refuse from the preparation of various small articles from hardened casein. The amounts of organic nitrogen transformed into nitric nitrogen during 3 months when the different materials were mixed with a suitable soil at rates furnishing 1 gm. of nitrogen per kilogram of soil are shown in the following table:

Nitric nitrogen formed during three months with different organic fertilizers furnishing 1 gm. of nitrogen.

	At end of one month.	At end of three months.	At end of five months.
	Grams.	*Grams.*	*Grams.*
Dried blood	0.168	0.345	0.634
Galalith	.005	.217	.600
Wool waste	.019	.230	.373
Roasted wool	.090	.309	.536
Crude ammonia	....	.014	.199
Wine lees	.051	.070	.086

The dried blood nitrified most readily. The galalith nitrified very slowly at first, but afterwards more readily. The wool waste was much inferior to the roasted wool as regards rate of nitrification. The crude ammonia nitrified very slowly during the earlier stages of the experiment, but with a higher temperature nitrification was quite rapid. The nitrification of the wine lees was very unsatisfactory. The order of efficiency of the different fertilizers in pot experiments with oats was as follows: Dried blood, roasted wool, galalith, wool waste, wine lees, crude ammonia.

In discussing these experiments, A. C. Girard called attention to the fact that this method of comparing fertilizers was inaugurated by Müntz and Girard more than 15 years ago and that it has been shown to be a valuable method of determining the relative value of organic nitrogenous fertilizers.

On the importance of nitrification for cultivated plants, W. KRÜGER (*Landw. Jahrb.*, *34* (*1905*), *No. 5*, *pp. 761–782*, *pls. 3*; *abs. in Chem. Centbl.*, *1906*, *I*, *No. 1*, *pp. 71*, *72*).—The general object of the experiments here reported was to determine whether ammonia is directly assimilated by cultivated plants or whether it must first be transformed by nitrification.

The experiments, which were begun in 1899, were made in pots containing a mixture of 50 per cent sand and 50 per cent ordinary farm soil. One series of pots was sterilized and another was not sterilized. They all received the same basal application of phosphoric acid and lime. Some in each series received no nitrogen, some nitrogen in the form of ammonium salts, and others nitrogen in form of nitrate of soda. The crops experimented with included mustard, oats, barley, potatoes, and fodder beets. The data recorded include the yields and nitrogen content of the plants, as well as qualitative tests of water extracts of the soils.

The results show that mustard, oats, and barley derive nitrogen from ammonium salts and nitrates with equal facility, and that for such crops these two sources of nitrogen are equally valuable. Potatoes appear to prefer ammonia to nitrate as a

source of nitrogen. At least, the action of the first is in no way inferior to that of the second. Beets are much more responsive to applications of nitrate than ammonia nitrogen, and their growth is especially promoted by applications of nitrate.

It appears from these facts that the inferior action of ammonia nitrogen sometimes observed in practice may not be due to inherent superiority of nitrate, but to unlike physiological and other conditions which interfere with the biological processes in the soil. In almost all of the sterilized pots the application of soluble forms of nitrogen gave smaller yields or no increase of yield as compared with pots receiving no nitrogen. This result is also attributed to interference with biological processes. Cultivated plants not only utilize ammonia nitrogen but generally assimilate it to the same extent as nitrate nitrogen. Nitrification is therefore not so necessary for the growth of cultivated plants as is generally supposed. Beets and potatoes represent extremes in this respect among the plants experimented with. The results in general do not warrant the changing of recommendations based on the importance of nitrification, since this process is useful in rendering insoluble soil nitrogen available for plants.

The influence of fertilizing and of plant growth on soil properties and soil exhaustion, W. Krüger (*Landw. Jahrb., 34 (1905), No. 5, pp. 783–804, pl. 1, dgms. 2; abs. in Chem. Centbl., 1906, I, No. 1, p. 72*).—In connection with the study of nitrification noted above, it was observed that the soils receiving different treatments were very variable with reference to their behavior when shaken up with water and allowed to settle, and that their content of soluble lime and magnesia, as well as the proportions of these constituents which were precipitated when sodium carbonate and hydrate were added in the tests for ammonia, varied within wide limits.

The experiments here reported were designed to further study the nature and cause of these variations. They were made in pots each containing 6 kg. of the same soil mixture used in the nitrification experiments, to which there were added in different cases, in addition to the basal fertilizer of phosphoric acid and lime, ammonium sulphate (furnishing 2 gm. of nitrogen), potassium nitrate (14.4 gm.), and sodium nitrate (12.1 gm.), chlorid (8.4 gm.), sulphate (10.1 gm., water-free), carbonate (7.6 gm.), and hydrate (5.7 gm.).

Series of experiments were made with potatoes, mustard, oats, barley, and fodder beets. It was observed in all cases, though more marked with some crops than with others, that the application of nitrate of soda reduced the porosity of the soil, increased the tendency to puddle, and interfered with settling when the soil was shaken with water and allowed to stand. It also increased the tendency to form crusts and clods. These results are attributed to the accumulation of soda in the soil, with consequent formation of sodium carbonate. The application of ammonium sulphate resulted in an increase in solubility of lime and magnesia compounds in the soil. Sodium salts, especially sodium carbonate, reduce the solubility of these substances.

Fixation of atmospheric nitrogen by plants, Trabut (*Bul. Agr. Algérie et Tunisie, 11 (1905), Nos. 23, pp 513–516; 24, pp. 537–547, fig. 1*).—This is a general discussion of the subject, summarizing the more practical results of investigations on the fixation of nitrogen by leguminous plants and the various methods of soil inoculation to promote such fixation which have been proposed.

The utilization of atmospheric nitrogen by means of micro-organisms, R. Thiele (*Landw. Vers. Stat., 63 (1905), No. 3–4, pp. 161–238, figs. 5; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 520, II, p. 114*).—This article reviews the present knowledge relating to Azotobacter, and reports a series of studies of the behavior of the organism in various liquid and solid media; the occurrence of Azotobacter in different soils and its culture in sterile soil; the variation in the nitrogen content of field

soils and its determination (see E. S. R., 17, p. 436), and the optimum temperature for Azotobacter as compared with soil temperatures.

The results, which are reported in detail, show that while there is no doubt as to the power of Azotobacter to fix nitrogen under laboratory conditions, it is not certain that this is a specific characteristic like the power of yeast to produce alcohol. It is thought possible that when the organism is supplied with a large amount of organic matter containing nitrogen its nitrogen-fixing power may be destroyed, and, like yeast when grown in peptone media, may show very different properties from those ordinarily in evidence.

The growth of Azotobacter in artificial media is not therefore to be considered unique or typical. The mode of operation of the organism in the soil is very imperfectly understood and can not be thoroughly cleared up until more accurate methods of determining the very small variations in nitrogen content of the soil which are involved in studies of this kind are secured. Moreover, the temperature conditions in laboratory cultures do not obtain in the natural soil, and therefore the optimum conditions for activity of the organism are not always present. In view of the fact that the life and the work of Azotobacter are still to a large extent unsolved problems, the practical man is not warranted in expecting that Azotobacter fertilizing will in the near future take the place to any extent of applications of nitrate of soda.

Numerous references to the literature of the subject are given and the methods and apparatus used in the experiments reported are described.

The assimilation of free elementary nitrogen by micro-organisms, J. VOGEL (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *15* (*1905*), *Nos. 2-3*, *pp. 33-53; 4-6*, *pp. 174-188; 7-8*, *pp. 215-227*).—A review is given of the more important investigations on this subject, bringing out especially how chemical treatment of the soil and use of fertilizers may retard or promote the activity of different groups of these organisms. A bibliography of the subject containing 148 references is given.

Nitrogen-fixing bacteria, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt.*, *13* (*1905*), *pp. 343-346*, *pls. 3*).—The history of investigation on this subject is briefly reviewed, and experiments on beans, peas, vetches, and red clover with the inoculating material prepared by this Department are reported.

"The results proved (1) that on land which will already produce a good crop of legumes the inoculation is of little benefit to the crop treated, but (2) it increases the number of nodules on the roots and consequently the quantity of nitrogen left in the soil for the benefit of a following crop, such as grain or roots, which have not the power of providing nitrogen for themselves; (3) the inoculated seed invariably gave better results than the inoculated soil."

The relative merits of inoculation by means of infected soil and by pure cultures are discussed and directions and precautions to be observed in the use of inoculating material are given.

Cooperative experiments with nodule-forming bacteria, F. C. HARRISON and B. BARLOW (*Ontario Agr. Col. and Expt. Farm Bul. 148*, *pp. 19*, *figs. 7*).—This bulletin contains brief statements regarding the history of the discovery of these organisms and summarizes the results of tests made by farmers in different parts of Canada of liquid cultures distributed by the Agricultural College at Guelph.

The cultures were sent out in small bottles in such condition that all the farmer had to do was to mix the contents of the bottle with a measured quantity of water and then apply to his seed. Cultures for alfalfa, alsike clover, red clover, white clover, soy beans, vetches, peas, and beans were distributed. Of the 134 reports received, 91 showed benefit from inoculation, 40 no advantage, and 3 stated that the organisms were already present in the soil. Extracts from the individual reports are given as well as detailed directions for using the cultures.

Tests of commercial cultures of nitrogen-fixing bacteria (*U. S. Dept. Agr.*, *Office Sec. Circ. 16*, *folio*).—This circular calls attention briefly to the limitations of

the value of inoculation, and reports the results of tests of 19 samples of cultures of nitrogen-fixing bacteria obtained in the open market. These results show that a large proportion of these cultures were either of poor quality or worthless.

The fertilizing value of atmospheric nitrogen preparations, M. HOFFMANN (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 6, pp. 43–46*).—A summary is given of information relating to methods of preparing and the fertilizing value of "N" fertilizer, lime niter, lime nitrogen, and similar compounds, prepared by various processes from the nitrogen of the air.

Some experiments with lime nitrogen on mineral and moor soils and investigations on the decomposition of calcium cyanamid in various kinds of soil, H. VON FEILITZEN (*Verhandl. Gesell. Deut. Naturf. u. Aerzte, 76 (1904), II, 1. Abt., pp. 157–159; abs. in Chem. Centbl., 1906, I, No. 7, pp. 584, 585; Centbl. Agr. Chem., 35 (1906), No. 2, p. 137*).—The substance of this paper has been noted from another source (E. S. R., 17, p. 17).

Barnyard manure, A. VIVIEN (*Monit. Sci., 4. ser., 19 (1905), No. 2, pp. 773–779; abs. in Chem. Centbl., 1905, II, No. 20, p. 1507*).—The results of studies of the influence of various substances, such as gypsum (2 per cent), chalk (2 per cent), starch (2 per cent), lime refuse from beet-sugar manufacture (3 per cent), formol (0.5 per cent), superphosphate (2 per cent), iron sulphate (1 per cent), sulphuric acid (0.5 per cent), roasted pyrites, mineral phosphates, nitrate of soda (1 per cent), etc., on the transformation of nitrogen compounds in manure are reported.

The smallest loss of ammonia was observed in case of gypsum. Superphosphate, iron sulphate, and sulphuric acid were less effective than was expected. The greatest losses occurred in untreated manure and in that to which chalk and lime refuse were added. In untreated manure and in that treated with mineral phosphate, roasted pyrites, sulphuric acid, crude potash, starch, and formol considerable amounts of nitrate were formed; in manure treated with superphosphate, iron sulphate, gypsum, chalk, and lime refuse only traces were found, and when sodium nitrate was added it was largely decomposed and lost.

The loss of dry matter in manure kept for 3 months in casks varied from 18.22 to 38.13 per cent, and of total nitrogen from 12.07 to 23.72 per cent, except in case of manure to which sodium nitrate was added, in which the loss was 31.21 per cent. The use of acid substances did not reduce the loss. The ammonia thus fixed was apparently easily nitrified and later denitrified and lost.

Litter and nitrogen, R. HORNBERGER (*Ztschr. Forst u. Jagdw., 37 (1905), p. 71; abs. in Centbl. Agr. Chem., 34 (1905), No. 11, pp. 726, 727*).—Pot experiments with leaves of various kinds to test the accuracy of Henry's conclusion (E. S. R., 16, p. 444) that dead forest leaves have the power of fixing appreciable amounts of atmospheric nitrogen are reported. The experiments extended over a year, and in only 2 cases out of 7 was there any gain of nitrogen. The results therefore do not confirm Henry's conclusion.

Crude ammonia, GUERRAPAIN (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 22, pp. 506–509*).—The origin, character, and agricultural uses of a by-product obtained in the manufacture of gas by passing the impure gas through a mixture of lime, iron sulphate, and sawdust, the mixture afterwards being dried and known as crude ammonia, are briefly discussed.

The material is shown to contain from 4 to 10 per cent nitrogen in form of ammonium sulphate and of cyanids. It is of value as a fertilizer, but on account of the poisonous cyanids and sulphur compounds present it must be applied some time—3 or 4 months—before seeding, in order to secure thorough oxidation of the poisonous compounds. It has been used successfully on sugar beets in amounts furnishing 75 to 100 kg. of nitrogen per hectare.

The material is said to have considerable value as a weed exterminator and insecticide, especially for grape phylloxera, when used at rates of 1,200 to 3,000 kg. per hectare.

Crude ammonia, A. GRAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 3, pp. 78–80*).—The agricultural value of this product (see preceding note) is discussed and directions given for its use.

Analyses are reported which show a variation in total nitrogen content of 3 to 7 per cent. Tests which have been made of it show that it gives best results on light soils in which nitrification is most active. It is safest to apply it in December or January on land that is to be seeded in the spring. It gives good results on beets and potatoes when applied at rates of 1,000 to 1,200 kg. per hectare, and on oats at rates of 500 to 600 kg. and lightly harrowed in.

Analysis of nitrate of soda, R. BENSEMANN (*Ztschr. Angew. Chem., 18 (1905), No. 50, pp. 1972–1974*).—The author sets forth in complete and orderly form his method of examining this substance, which has been given in a number of previous articles (E. S. R., 17, pp. 7, 218).

Acid versus basic phosphatic fertilizers, W. F. SUTHERST (*Chem. News, 92 (1905), No. 2403, pp. 274, 275*).—It is stated that when superphosphate is added to a soil containing excess of lime phosphates are formed which are insoluble in water but soluble in dilute organic acids, and if alumina and oxid of iron are in excess of lime a still further reversion to insoluble forms results.

When basic slag, however, is used a reverse reaction occurs. For this reason, therefore, the author concludes that basic slag should be a more valuable fertilizer generally than superphosphate, although slower in action because it is not so perfectly distributed as the reverted superphosphate. Comparative tests of superphosphate, basic slag, and basic superphosphate (superphosphate supersaturated with lime) on mangolds are briefly reported, showing that the increased yield with the basic phosphates was greater than with the superphosphate.

On the fertilizing action of certain accessory compounds in slags, GUFFROY, CRÉPEAUX, and MILON (*Rev. Gén. Agron., 14 (1905), No. 10–11, pp. 461–464; Bul. Soc. Nat. Agr. France, 65 (1905), No. 6, pp. 479–483*).—A series of pot experiments is reported which were designed to determine especially the fertilizing value of the silica and manganese occurring in phosphatic slags.

Comparative tests were made with wheat, buckwheat, and clover of ordinary Thomas slag containing 8.41 per cent of silica and 3.87 per cent of manganese oxid, and of carefully separated crystals of tetraphosphate and of silicophosphate, using the latter either alone or with the addition of substances necessary to approximate the composition of natural slag. The amount of complete artificial slag furnishing 78.1 gm. of phosphoric acid (the amount used in each experiment) contained 42.05 gm. of silica and 19.35 gm. of manganese. The low-silica slag, furnishing the same amount of phosphoric acid, contained 4.72 gm. of silica, and the low-manganese slag 7.17 gm. of manganese.

The results show that in case of buckwheat the absence of silica retarded maturity and reduced the yield of straw as well as the weight of the floral envelopes and branches. In case of wheat the absence of silica resulted in retarding the heading and flowering, but was apparently without effect upon the yield. The effect upon strength of straw was not appreciable. The growth and yield of clover were appreciably reduced in absence of silica in the fertilizer. The absence of manganese from the fertilizer produced results similar to those obtained in case of silica as regards the growth and yield of buckwheat, except that they were less marked. The anatomical structure of the plant, however, was affected to a greater extent by the absence of manganese than of silica. Like results were obtained with wheat and clover.

The results in general, therefore, show that the silica and manganese contained in Thomas slag are of considerable importance as fertilizers. On the other hand there was apparently some superiority of the phosphoric acid of the tetraphosphate over that of the silicophosphate, but this is to be further studied.

Comparative experiments with high percentage and low percentage Thomas slag (*Deut. Landw. Presse, 32 (1905), No. 79, pp. 667–669, figs. 4*).—Plat experiments with rye and oats, using equal money values of the two slags (the low-percentage slags containing not more than 5 per cent of citric-acid soluble phosphoric acid), showed the high-percentage phosphate to be more economical. See also E. S. R., 16, p. 1064.

Citric-acid soluble phosphoric acid in Thomas slag, M. DE MOLINARI and O. LIGOT (*Bul. Agr. [Brussels], 24 (1905), No. 5, pp. 909–916; 6, pp. 1116–1118*).—Comparative pot tests of untreated Thomas slag and that which had been exhausted with citric acid according to the Wagner method are reported. The results show that the yield of oats was normal with the untreated slag but practically nil with the extracted slag.

Phosphate mining in Tennessee, D. S. COOKE (*Amer. Fert., 23 (1905), No. 5, pp. 5–10, figs. 8*).—This article discusses the rapid growth of this industry, some of the difficulties encountered in developing it, the peculiarities of laborers, and the present outlook.

Algerian phosphate and apatite (*Mitt. Deut. Landw. Gesell., 20 (1905), No. 46, pp. 389–391*).—This is a summary of experiments by Söderbaum in Sweden, comparing the composition and fertilizing value of Algerian phosphate and Norwegian apatite when applied to oats grown on sandy soils and peas grown on moor soils. The results show in general the superiority of the Algerian phosphate.

Experiments on the assimilation of potash and soda by plants, T. PFEIFFER ET AL. (*Mitt. Landw. Inst. Breslau, 3 (1905), No. 4, pp. 567–613; abs. in Chem. Ztg., 30 (1906), No. 10, Repert. No. 2, pp. 25, 26*).—The numerous investigations on this subject which have been made in recent years are referred to.

A series of pot experiments made during 1903 and 1904 on barley with potash-containing and potash-free artificial zeolites (potassium, sodium, and calcium zeolites) is reported, the object of the experiments being to study the capacity of plants to utilize the potash of such compounds, the influence of potash-free zeolites on the utilization and the fixation of the potash salts applied with them, and the extent to which applications of sodium salts overcome the unfavorable action of potash-free zeolites. The zeolites and necessary basal fertilizers were applied to pots containing 4 kg. of sand. The yield and potash and soda contents of the total crop, straw, and grain are recorded.

The results show that the potash of zeolites was readily utilized by the plant (as high as 88 per cent). The potash content of the grain remained fairly constant, but that of the straw varied widely with the amount of potash available for the uses of the plant. The action of potash fertilizers was somewhat reduced by applying them in connection with sodium and calcium zeolites, thus indicating some fixation of the potash in less available forms. Increasing the applications of potash lowered the sodium content of the plants. Incidentally it was observed that sand which had been treated with soda solution and hydrochloric acid yielded more potash and soda to the plants than that which had not been treated.

The indirect action of soda on the utilization of potash, which the experiments indicate, is ascribed to an exchange of bases. In case of soils rich in potash this exchange of bases may result in a sufficient supply of potash to crops for a number of years. It is, however, a species of soil robbery and will ultimately result in potash exhaustion. The same is true of the continuous use of potash salts rich in sodium chlorid, although in this case exhaustion is not so rapidly brought about.

Sodium salts act in two ways, (1) by setting free potash in the soil, and (2) by replacing potash in plants. In case of a crop like barley, the need of the grain for potash is first supplied, and if there is a deficency of potash for the whole plant soda replaces the potash in the leaves and stalks, thus making the potash available for the uses of the grain. It appears, therefore, that sodium salts enable the plant to make the best possible use of a given amount of potash in the production of grain.

The author concludes in general that applications of sodium salts in connection with potassium salts result in a greater assimilation of potash, which is shown in a greater total production in the case of barley in which the grain does not participate except to the extent that a part of the potash of the stems and leaves is replaced by soda, leaving the potash available for the production of the grain.

It is suggested that the plant food value of the elements may be a periodic function of their atomic weights and that elements like potassium of the medium atomic weights may be termed phyto-chemic.

Manuring with potash salts, C. DUSSERRE (*Chron. Agr. Vaud, 18 (1905), No. 23, pp. 567–575, fig. 1*).—A brief account is given of experiments which have been carried on at a number of places in Lausanne since 1898 to determine the value of potash salts as fertilizer for grass lands.

Soils of widely different geological origin and mechanical and chemical composition were used in these experiments. The total content of potash in the soils varied from 7.9 gm. per kilogram of fine earth in a peaty soil to 22.2 gm. in an alluvial soil. The soluble potash varied from 0.4 gm. in an alluvial soil to 1.28 gm. in an erratic clay soil. There was apparently no strict relation between the total and soluble content of potash in the soil and the effect of the potash salts, although the potash fertilizers were in general beneficial in the Jurassic formations, which are as a rule poor in potash, while in crystalline (granite) formations or in crystalline schists (gneiss), in which potash is abundant, the use of potash fertilizers produced less effect.

The results in general indicate that through a series of years the use of potash salts was profitable on all the soils experimented with. The liberal use of phosphatic, nitrogenous, and calcareous fertilizers for a number of years renders the use of potash fertilizers necessary. The amount of assimilable potash in the soil becomes exhausted, and the amount which the soil yields to the plant is not sufficient to meet the demands of the large crops produced by the use of the other fertilizers. The crops which especially require applications of potash are beets, potatoes, tobacco, forage plants, etc.

Kainit, L. BARGERON (*Jour. Agr. Prat., n. ser., 10 (1905), No. 48, pp. 688–690*).—The various salts included under this general name in France, as well as potash salts from other sources, such as sea-weed ashes, sea water, etc., are briefly discussed.

A molasses-potash fertilizer, O. REITMAIR (*Separate from Wiener Landw. Ztg., 1905, No. 94, pp. 8*).—This article briefly discusses the fertilizing value of the material obtained by drying or by burning the residue from the distillation of molasses. The dry product has been put on the market under the name of chilinit, which contains considerable amounts of nitrogen as well as potash. The burned product contains a higher percentage of potash but no nitrogen, but is very variable in composition.

On the successful use of manganese as a fertilizer, G. BERTRAND (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 26, pp. 1255–1257; Jour. Agr. Prat., n. ser., 11 (1906), No. 2, pp. 42, 43*).—The author refers to his work on laccase as convincing him of the physiological importance of manganese, and quotes the work of several other investigators as confirming his conclusions. He reports field experiments with oats on two plats both of which received the same basal fertilizer, but only one was fertilized with manganese sulphate at the rate of 50 kg. per hectare (44.53 lbs. per acre).

There was an increase on the plat receiving manganese of 22.5 per cent in total crop, 17.4 per cent in grain, and 26 per cent in straw. The grain from the manganese plat was somewhat heavier than that from the other and contained somewhat less water, but was otherwise of practically the same composition. The percentage of manganese present in the grain was very minute.

The recovery of products of commercial value from sewage sludge, J. GROSSMANN (*Jour. Soc. Chem. Indus., 24 (1905), No. 12, pp. 655-659*).—A plant constructed at Bradford in Yorkshire, on plans prepared by the author, for the distillation of sewage sludge is described and the principles upon which plants should be constructed and operated are discussed. These in brief are as follows:

"(1) The sludge should be heated in comparatively thin layers. . . . (2) The furnaces should be capable of maintaining an even heat at temperatures varying from 200° to 500° C., or even more. (3) Manual labor should be dispensed with as far as possible by the substitution of mechanical appliances by which the process could be made continuous, and almost automatic. (4) Under these circumstances it would be impracticable to maintain a high vacuum, but a slight minus pressure in conjunction with superheated steam would be most likely to give satisfactory results."

The products obtained in this plant, the cost of installation of which was about $20,000, and which required 2 tons of coke per day, are "7 tons of residue, containing besides free carbon about 2 per cent of nitrogen, corresponding to 8 per cent of ammonia sulphate and 1 per cent of phosphoric acid, equal to a little over 2 per cent of calcium phosphate, and a quantity of grease which depends on the original quantity contained in the sludge." Means of increasing the salable products are discussed.

Plant analysis as an aid in estimating the manurial requirements, with special reference to hops, P. SCHNEIDER (*Wchnschr. Brau., 22 (1905), pp. 456-458; abs. in Chem. Centbl., 1905, II, pp. 970, 971; Jour. Chem. Soc.* [*London*], *88 (1905), No. 517, II, p. 755*).—The analyses made by the author show that the more advanced leaves of hops showed a definite minimum of phosphoric acid when this substance was deficient in the soil. This was most evident at time of the first crop in the lower leaves, but at time of the second crop in the upper leaves. The nitrogen followed the same course as that of phosphoric acid and was best detected by analysis of the leaves. No definite results, however, could be obtained in the case of potassium, magnesium, and calcium.

Analysis of commercial fertilizers sold in Maryland, H. B. MCDONNELL ET AL. (*Md. Agr. Col. Quart., 1905, No. 29, pp. 64*).—This is a report on fertilizer inspection during the period from March to June, 1905, inclusive.

Inspection of fertilizers in 1905, F. W. MORSE ET AL. (*New Hampshire Sta. Bul. 123, pp. 133-144*).—This bulletin gives the results of analyses of 105 brands of mixed fertilizers collected by the State board of agriculture and analyzed by the chemist of the station. It also contains a short article on the use of commercial fertilizers. Among the samples inspected "there were 27 cases of failure to equal the guarantee in one or more ingredients, but in all but 9 of them a lack in one element was made good by an excess of another without affecting the value of the goods. The majority of deficits was found in available phosphoric acid in the lower grades of goods."

AGRICULTURAL BOTANY.

Calcium as a plant nutrient, V. V. YERMAKOV (*Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6 (1905), No. 1, pp. 63-65*).—The author carried on a series of experiments in light and darkness with seedlings of buckwheat, blue lupines, and detached leaves of various plants, to test the effect of calcium as a plant nutrient.

Seedlings were placed in normal nutritive solutions containing calcium salts and in solutions without calcium salts, and afterwards the plants were examined for the

presence of nitrates. Nitrates were observed in the cotyledons and also in the hypocotyl, the plants receiving the normal solutions containing nitrates only in the hypocotyl, and those which received no lime containing nitrates both in the hypocotyl and the cotyledons.

From his experiments the author concludes that the absence of nitrates in the cotyledons of normal plants indicates the formation of organic nitrogenous material at the expense of the nitrates, while in plants grown without calcium nitrates are not assimilated. The author tested the results in various ways, and concludes that the presence of lime in a nutritive solution is necessary for the assimilation of nitric-acid salts by plants, whether grown in darkness or in light.—P. FIREMAN.

Regeneration in plants, W. B. MCCALLUM (*Bot. Gaz., 40 (1905), Nos. 2, pp. 97–120, figs. 14; 4, pp. 241–263, figs. 9*).—A study was made of the influence of different factors on the regeneration of parts of plants, the principal investigations being made with bean seedlings. The influencing factors studied were wound stimuli, disturbance in nutrition, changes in water content, accumulation of formative substances, age and degree of maturity, correlation, and growth tension.

Summarizing his investigations, the author shows that the occurrence of regeneration in plants usually involves the replacement of the organs removed, but the same result is often obtained when the organ itself is not removed but is prevented from functioning. The plant possesses innumerable growing points, the majority of which do not develop if the plant body retains anything like a definite organization. In most cases this development does not occur, because these cells capable of producing new organs are held in check by those parts already growing. This nondevelopment does not seem to be due to any lack of conditions of favorable growth, but is due to some influence which an organ, acting perhaps along the protoplasmic connections, is able to exert over other parts and so prevent their growth. When this influence is removed, the favorable growth conditions present permit the growth of the parts to occur.

A bibliography of literature relating to this subject is appended.

The rôle of the albuminoid substances of leaves and their accumulation in ripening seeds, N. I. VASILYEV (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 4, pp. 385–400*).—In a previous article (E. S. R., 16, p. 746) the author expressed the view that the ripening process of seeds is the inverse of the process of germination, and he assumed that the albuminoid substances produced in the leaves are transported to the seeds, in which they are again transformed into albumin.

In the present investigation the author examined the leaves of the white lupine during various periods of ripening of the seeds, analyzing separately the petioles and the leaf blades. It was found that with the advanced development of the plants and the increasing ripeness of the seeds the amount of total nitrogen and of albuminoid nitrogen in the leaves decreased, while corresponding amounts of nitrogen increased in the seeds.

An examination of the distribution of the different groups of nitrogenous substances in the leaves and their petioles showed that the leaves are richer in total and albuminous nitrogen than the petioles. The petioles, on the other hand, are richer in nonalbuminoid nitrogen and especially in asparagin.

The author concludes that in leaves the nitrogenous substances are synthesized to albumin, and then remain in this form indefinitely as reserve substances. At the time of the formation of the seeds and during their ripening the leaves begin to deliver their reserve albuminous substances to the seeds. The reserve albumin, splitting up, is transported to the seeds in the form of such nitrogenous compounds as amido acids, asparagin, and organic bases.—P. FIREMAN.

The physiological anatomy of the root tubercles of some Leguminosæ, J. BERNATSKY (*Math. u. Naturw. Ber. Ungarn, 20 (1902), pp. 65–70, figs. 5*).—In this paper (not printed until 1905) the author reports a study of the anatomy of the

root tubercles of *Robinia pseudacacia*, *Tetragonolobus siliquosus*, and several species of Cytisus, Orobus, and Vicia, and he claims in every case to have determined the possibility of gas exchange through the cortex of the roots.

The effect of self-fertilization in the Leguminosæ, O. KIRCHNER (*Naturw. Ztschr. Land u. Forstw., 3 (1905), Nos. 1, pp. 1-16; 2, pp. 49-64; 3, pp. 97-111*).—Observations are given on the self-fertilization of about 100 species of Leguminosæ, representing 34 genera, the data in many instances being compiled from various sources, and in a number of cases the statements were confirmed by the author. About one-third of the species are reported as being self-sterile.

The effect of light on Melilotus alba, R. W. COPPEDGE (*Trans. Kans. Acad. Sci., 20 (1905), pt. 1, pp. 97-105*).—The author describes a number of experiments to test the effect of light on sweet clover, studying its effect on the nutation of leaves and stems, the relation between movement and strength of light, the relation between light and carbon dioxid gas in forming starch, and the time at which starch was formed and disappeared in the plant.

In studying the nutation of the leaves and stems, the author found that the hot-sun position assumed by the plant depends on the amount of moisture in the soil and not on the condition of the atmosphere, and that the opening and closing of the stomata depend on the relative humidity of the atmosphere. Nutation he found to take place in almost the entire stem of the young plant, being most noticeable in the pulvinus and decreasing toward the roots. As the plant grows older the region of nutation is diminished.

Experiments to determine whether the movement of the plants and leaves depended on the light only showed that light alone was the cause of the normal day movements of the plants, and the rate of movement was found to depend on the strength of the light.

In determining the relationship between light and carbon dioxid in starch formation the author experimented with leaves in different temperatures, in different colored lights, etc., and found that only in the presence of both light and air was starch formed and that it disappeared from the leaf when air only was present.

The experiments as to the time when the starch left the plant indicated that there was a gradual decrease of starch after midnight, with its reappearance in the morning. In one series of experiments all the starch had disappeared at 5 o'clock in the morning. In another series leaves were examined every half hour, beginning at 4 o'clock in the morning, and at this time the cells were crowded with starch. At 4.30 most of the starch had gone from the palisade cells; at 5 o'clock it was present only in the sieve-tubes, and a little in the cells bordering them; and at 5.30 all the starch had gone from the leaf. At 6 o'clock starch began to appear again in the palisade cells, showing that it disappears first from these cells and also reappears first in the palisade tissues.

The action of sulphur dioxid on plants, A. WIELER (*Untersuchungen über die Einwirkung schwefliger Saure auf die Pflanzen Berlin: Borntraeger Bro., 1905, pp. VII + 427; rev. in Nature [London], 73 (1906), No. 1895, pp. 385, 386*).—A monograph dealing with the injurious action of sulphur dioxid on plants, especially on forest trees.

About one-half of the volume is taken up with accounts of experimental examination of the action of the gas on plants, after which the demonstration of its action on leaves and proof that it enters through the stomata are given, together with accounts of its action on the soil, relation between height of trees and constitution of soil, resistance of plants to the gas, and the amount of gas in the air of contaminated regions.

It is claimed that sulphur dioxid was found in the leaves of all plants examined as far as 8 kilometers from any known source of pollution, but there was no relation between the degree of injury and the concentration of the poison in the air, nor could any

clear connection be detected between the quantity of sulphur dioxid in the leaves and the distance of these from the centers of contamination.

The author finds that the gas penetrates into the leaves solely through the stomata, a fact that has been disputed by a number of writers. He distinguishes between acute and chronic affection of plants, the former being due to the corrosive action of high percentages of sulphur dioxid within a short period, and the latter to the slow action of low percentages within a longer one. The author directs attention particularly to the latter class of injury. Different plants were found to react in a very dissimilar manner and to be unequally sensitive, and the author points out that it is necessary to distinguish between sensitiveness of organs and the resistance of a plant as a whole.

It is claimed that sulphur dioxid was found to adversely affect photosynthesis, but no critical concentrations could be established for different species. An inductive action of the poison was frequently noticed, by which it was shown that there was a direct action of the gas on the chloroplastids. In addition to corrosions due to acute affection, the characteristic effects of a chronic nature were observed to be precocious autumnal coloration and fall of the leaves and effects similar to these resulting from partial starvation. The author discusses the mode of action of the poison on plants, and believes that it unites particularly with the aldehydes present and that sulphuric acid is liberated, the injury being due to this acid.

The general features of chronically injured trees are said to be strikingly similar to those due to defective nutrition, and the author attributes the effects to the indirect action of sulphur dioxid on the soil, resulting in the removal of basic constituents and the consequent acidification due to humic acids. As a remedy for chronic injury the application of manures, especially basic ones, such as lime, is recommended.

The probable bacterial origin of the gum of linseed mucilage, R. G. SMITH (*Proc. Linn. Soc. N. S. Wales, 30 (1905), pt. 1, pp. 161–174*).—The production of gum or slime in plants by bacteria is believed to be abnormal in the case of sugar cane, various Leguminosæ, etc., but in the case of linden, flax, and quince, gum and mucilage are of such common occurrence that it is not so easy to believe that the origin may be bacterial. The author has examined the tissues of lime, quince, and flax bacteriologically, and in all cases has found slime-forming bacteria. It is a matter of common information that the seed of flax contains practically no starch, and that the digestible carbohydrates consist chiefly in mucilage.

In the present paper the auther gives an account of his studies with flax, and concludes that the gums of flax mucilages vary in their chemical reactions and are probably of different chemical constitution. The product of hydrolysis consists of galactose and reducing substances which yield indefinite osazones, and which are possibly allied to the furfuroids of Cross, Bevan, and Smith. The gum bacteria in the tissues of Linum are relatively very numerous and consist chiefly of races of 2 species. The chemical reactions of these gums are practically identical with the reactions of flax gum. The gum formed by one species is hydrolyzed to galactose, and the other to galactose and a reducing substance that yields an indefinite osazone.

The gum formed by bacteria is probably altered by the plant into mucilage and other substances required in the plant economy. A number of the so-called species of gum bacteria have probably one common origin, and the host plant can alter the nature of the gum product which influences the growth characters. Two species, *Bacillus lini I* and *B. lini II*, are described as new.

The ascent of water in trees, A. J. EWART (*Phil. Trans. Roy. Soc. London, Ser. B, 198 (1905), pp. 41–85, figs. 5*).—After briefly reviewing some of the theories regarding the ascent of water in trees the author describes his investigations with a number of species of trees and shrubs, and shows the influence of various factors on the conductivity of water.

In summarizing his results the author states that the flow of water through open vessels filled with sap takes place in accordance with Poiseuille's formula for the flow through rigid tubes, any divergences noticed being due to the presence of irregular internal thickenings in the vessels. The length of vessels in the woods examined varied from 7 to 36 cm. The resistance to transverse flow through the wood was found to be from 300 to 45,000 times greater than to longitudinal flow, and the resistance to filtration under pressure, through a single partition wall, in the case of the wood of the crab apple, was from 2 to 10 times greater than that to flow through the entire length of the vessels. The total resistance to flow in erect stems of actively transpiring plants appears to correspond in the case of shrubs and small trees to a head of water of from 6 to 33 times the height of the plant, and in the case of large trees from 5 to 7 times their height. This would require, to maintain active transpiration in tall trees, total pressures equivalent to at least 100 atmospheres.

It appears, therefore, that to maintain the flow a pumping action of some kind must be exercised in the wood, for which the presence of active living cells is essential. In support of this, it has been shown that the production of wood in a slow-growing tree is greater than is necessary for its mechanical requirements. There is no means by which the cells can directly pump water in a definite direction, although the existence of a power of absorbing and exuding water under pressure has been proved in the living wood of cut branches. It is suggested that the wood-parenchyma cells, by the excretion and reabsorption of dissolved materials, may bring into play surface-tension forces within the vessels of sufficient intensity to maintain a steady upward flow and keep the water of the Jamin's chains in the vessel in a mobile condition, ready to flow in whatever direction suction is exercised.

It appears that the terminal branches of trees at heights of from 22 to 44 ft. exhibit little or no power of bleeding in the spring. It is believed possible that in such trees the pumping action is only used or developed in the wood of the older stems, or is only exercised when transpiration is active, and the water columns in the vessels attain a definite size in proportion to the wood-parenchyma cells. The importance of the Jamin's chain in the vessels is that it renders a staircase pumping action possible, and enables the water to be maintained in them in a labile condition, ready to flow to any point where moderate suction is exercised. This pumping action being diffuse and probably regulated need not produce any high pressure of exudation at the terminal branches of tall trees, and, in fact, it appears always absent at high levels.

The artificial nutrition of diseased trees, S. A. Mokrzhetski (*Zeml. Ghaz., 1904, Nos. 9-13; rev. in Zhur. Opuitn. Agron.* (*Russ. Jour. Expt. Landw.*), *6* (*1905*), *No. 1, pp. 82, 83*).—The author conducted a number of experiments in which he introduced arsenic, copper sulphate, eosin, and other poisonous solutions into trees for the purpose of destroying parasites, but did not obtain any very satisfactory results.

He then replaced the poisonous salts by nutritive ones and obtained interesting results in improving the condition of the trees. For the introduction of dry salts into the trunk of the tree holes ½ in. in diameter and 1 in. deep were bored into the trunk at about breast height. Into these holes 1 to 4 gm. of salts was placed and the openings covered with land plaster. For trees not over 3.5 in. one hole was sufficient, but for larger trees 2 to 4 holes were found necessary. For trees with a diameter of 7 to 9 in. 10 to 12 gm. of salts was used. It was found that the earlier in the spring the salts were introduced the better the results.

For different soils and under different conditions of growth the author used fertilizing mixtures recommended by Wagner, Sorauer, and Muller-Thurgau. To the last mixture he found it advantageous to add 1 part iron sulphate, to be used for curing chlorosis. The experiments showed that the dry salts diffused through the trees in different ways, not only along vertical lines but sometimes in spirals. The

introduction of nutritive solutions of varying concentration, while giving positive results, were not found as efficient as dry salts.—P. FIREMAN.

Investigations on the starch and fat content of fir trees, L. FABRICIUS (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 4, pp. 137–176, pls. 2*).—Investigations are reported on the fluctuation of the reserve materials in the fir tree at different periods of the year. The trunks and roots of trees of various ages were examined at eight different times during the year and their starch and fat content determined.

Physiological investigations on the reserve material of trees, LECLERC DU SABLON (*Rev. Gén. Bot., 18 (1906), Nos. 205, pp. 5–25, figs. 7; 206, pp. 82–96, figs. 6*).—In a previous publication (E. S. R., 14, p. 1045) an account was given of observations on the reserve carbohydrates in the leaves, stems, and roots of chestnut and other deciduous trees at different times of the year.

In the present memoir the investigations are extended to include trees with persistent foliage, and also to test the effect of decortication on the production and transfer of carbohydrates. Among the evergreen trees studied were the holly oak, Austrian pine, larch, and Japanese and European euonymus, and among the deciduous trees, the pear, quince, etc. In addition to the carbohydrate reserves, observations were made on other reserve materials, water contents, etc.

In the case of trees with persistent foliage the synthesis of carbohydrates takes place with varying degree throughout the year. The reserve supply is drawn upon in the spring of the year when the buds are unfolding and also during periods of intense respiration. As a result the minimum of reserve material occurs during the summer, from which time it increases throughout late summer and winter, attaining the maximum just before the spring budding. With the deciduous species the carbohydrate assimilation takes place only during the summer season, or from April to October, but during that period it is much more vigorous than in the case of evergreens.

The maximum of carbohydrate reserves in both stems and roots coincides with the autumnal fall of the leaves. In the spring of the year when young shoots are being put out rapidly the minimum of the reserve material is noted. The young shoots seem to be largely formed from the stored reserves of the stems and roots, and the abundance of the reserves determines the winter respiration of the tree, as well as the extent of the new spring growth. In all the species studied an increase in the water content of the trees was noticed just at the period of the beginning of growth in the spring, and in general a maximum of carbohydrate reserve material and a minimum of water are coincident. The water content is said to depend more upon the state of growth than on the degree of soil humidity.

Attention is called to the fact that the starch in the carbohydrate reserve material diminishes during winter and shows an increase in the spring of the year, and in general the maximum of carbohydrates is accompanied by a minimum of starch. This is explained by the theory of the transformation of starch into reserve cellulose, which is again changed to a starch or some similar body preparatory to use by the tree.

Contributions to the biology of Rhizobia. IV, Two coast Rhizobia of Vancouver Island, B. C., A. SCHNEIDER (*Bot. Gaz., 40 (1905), No. 2, pp. 135–139, figs. 3*).—The author describes the micro-organisms occurring in the tubercles found on the roots of 2 species of leguminous plants, beach vetch and beach clover, common on Vancouver Island. These forms present quite different morphological characters, and it is thought probable that there are extreme types which are derived from an original form similar to, but not necessarily identical with, that occurring on cassia, black locust, and other species of leguminous plants.

Contributions to the biology of Rhizobia. V, The isolation and cultivation of Rhizobia in artificial media, A. SCHNEIDER (*Bot. Gaz., 40 (1905), No. 4,*

pp. 296–301).—The author has successfully examined, isolated, and cultivated the micro-organisms growing in the root tubercles of red, white, bur, and sweet clover, garden peas, and alfalfa, and the results obtained have been so satisfactory that he gives a detailed account of the methods pursued.

Directions are given for the selection of the tubercles, methods of treatment, and transfer to nutrient media. The author prefers the slightly alkaline solid media of beef extract, salt, gelatin, and agar, only sufficient agar being used to give solidity. The directions for preparing tubes and their inoculation, as well as for plating the contents of the inoculated tubes, are given in detail. One reason for apparent failure in the culture of these organisms is believed to be the fact that the morphological characteristics are entirely changed, so that there is little similarity between the organism as it appears in the tubercle and that appearing in the artificial culture media.

The delta of the Rio Colorado, D. T. MACDOUGAL (*Contrib. N. Y. Bot. Gard., 1906, No. 77, pp. 16, figs. 6, map 1*).—The physical and topographical features of the region are described, after which the author gives lists of the plants found and their uses, and discusses briefly the agricultural possibilities of the region through the extension of irrigation.

The poisonous plants of Indiana, S. COULTER (*Proc. Ind. Acad. Sci., 1904, pp. 51–63*).—A list is given of a large number of species of plants that are reputed to be poisonous by contact, the species being embraced in about 40 genera and many distinct orders of plants. The author has been led to doubt the poisonous action of many of the plants, and he has conducted investigations with fresh material of all of them as far as available, and as a result has greatly reduced the number of plants which are known to be contact poisons.

The poisonous plants may be readily separated into two groups. In one the skin irritation is due to the action of some specific substance of the plant, while in the other it is mainly due to mechanical causes. The method of experimental study was to handle the plants freely, and if after some days no results were apparent, the part of the plant said to contain the poisonous element was rubbed upon the back of the forearm until serum, and at times blood, exuded, the juice of the plant and the serum being allowed to dry upon the arm. If no results followed it was considered safe to infer that the plant was not a contact poison.

Detailed results are given of the investigations of the different species enumerated in the list, and in conclusion the author states that the great majority of the plants included in the list are harmless under ordinary handling. Some may act as skin irritants as the result of prolonged application or unusually rough handling. Careful washing after handling any of the forms will reduce the danger to a minimum.

The species found to be definitely contact poisons, arranged in order of their virulence, are *Rhus vernix*, *R. radicans*, *Euphorbia corollata*, *Cypripedium hirsutum*, *Anthemis cotula*, *Erigeron* [*Leptilon*] *canadense*, *Clematis virginiana*, and *Bidens frondosa*. This list does not include the nettles or a number of forms which poison under unusual conditions, such as grinding, powdering, or long-continued application. Of the plants mentioned above, the two species of the genus Rhus are the only ones which affected all the experimenters. The greater number of the plants experimented with proved absolutely harmless under all conditions of experiment.

FIELD CROPS.

Results obtained in 1905 from trial plats of grain, fodder corn, field roots, and potatoes, W. and C. E. SAUNDERS (*Canada Cent. Expt. Farm Bul. 53, pp. 48*).—The results secured in 1905 in variety tests with the different field crops conducted for the past 11 years on uniform trial plats are given mainly in tabular form. The reports for earlier years have been previously noted (E. S. R., 16, p. 961).

The average yield of 26 varieties of spring wheat tested on all the experimental farms in 1905 was 29 bu. 5 lbs. Of 26 varieties tested for 5 years, Preston and Advance stood first with an average yield of 35 bu. 13 lbs. and 34 bu. 42 lbs., respectively. Twelve of these varieties, including the 2 just mentioned, were crossbred sorts produced on the experimental farms. The average number of days required for the 26 varieties of spring wheat to reach maturity ranged from 111 to 121. The average yield of 4 varieties of macaroni wheat grown on all the farms this season was 31 bu. 37 lbs. per acre. The average yield for 5 years of Roumanian was 37 bu. 55 lbs., and of Goose, 36 bu. 23 lbs. Roumanian ripened in 121 days and Goose in 119. The average yield on all the farms of 4 varieties of emmer and spelt in 1905 was 2,270 lbs. per acre. In average yield for 2 years common emmer stood first with 2,280 lbs. and white spelt last with 1,915 lbs. per acre.

Thirty-nine varieties of oats under test in 1905 yielded on an average at all the farms 83 bu. 6 lbs. per acre. Thirty varieties tested for 5 years showed a range in average yield of from 69 bu. 26 lbs. to 85 bu. 24 lbs. per acre. The most productive varieties, given in the decreasing order of yield, were Banner, Abundance, Lincoln, Danish Island, Improved American, Siberian, Wide Awake, Holstein Prolific, White Giant, Golden Beauty, Golden Tartarian, and Columbus, all yielding over 80 bu. per acre for the 5 years. Of the varieties under test 5 were crossbred sorts produced on the farms.

The average crop of 18 varieties of six-rowed barley for the season was 54 bu. 28 lbs. per acre. Twelve of the varieties under test were crossbred sorts produced on the experimental farms. In average yield for 5 years Mensury stood first with 56 bu. 38 lbs. per acre. Sixteen of the 18 varieties gave a yield per acre of over 50 bu. The average yield of 14 varieties of two-rowed barley in 1905, including 8 crossbred sorts, was 48 bu. 3 lbs. per acre. The average yields for 5 years ranged from 44 bu. 46 lbs. to 51 bu. 2 lbs. per acre, the leading varieties yielding over 50 bu. being, in decreasing order of yield, French Chevalier, Danish Chevalier, and Standwell.

The 26 varieties of peas tested this year gave an average yield of 39 bu. 39 lbs. per acre. Fourteen of the varieties, including 3 in the list yielding over 40 bu. per acre, were crossbred varieties originated on the farms. The leading varieties under test for 5 years, in decreasing order of yield, were Mackay, English Gray, Early Britain, Agnes, and Prince, all yielding over 40 bu. per acre. The average yield for 5 years of the entire list varied from 37 bu. 30 lbs. to 41 bu. 2 lbs. per acre.

Twenty varieties of corn tested on all the farms in 1905 gave an average yield of 21 tons 1,397 lbs. per acre. The highest average yield for 5 years, 22 tons 400 lbs., was produced by Thoroughbred White Flint. Six varieties produced an average yield of over 19 tons per acre for 5 years.

Twenty varieties of turnips gave an average yield of 28 tons 795 lbs. per acre for the season; 16 varieties of mangels, 30 tons 620 lbs.; 10 varieties of carrots, 22 tons 556 lbs.; and 8 varieties of sugar beets, 24 tons 1,284 lbs. per acre. The leading varieties in average yield for 5 years were as follows: *Turnips*—Perfection Swede, Magnum Bonum, and Hall Westbury, all yielding over 32 tons per acre. *Mangels*—Half Long Sugar White, Mammoth Yellow Intermediate, Mammoth Long Red, and Lion Yellow Intermediate, the yield of the first variety being 32 tons 295 lbs. per acre, and that of the other 3 over 31 tons. *Carrots*—Giant White Vosges, New White Intermediate, Ontario Champion, and Mammoth White Intermediate, all yielding over 23 tons per acre. *Sugar beets*—Red Top Sugar and Royal Giant, yielding over 26 tons, and Danish Red Top, yielding over 25 tons per acre.

Forty varieties of potatoes were grown this season on all the experimental farms, and the average yield per acre secured was 444 bu. 16 lbs. The range in average yield of 34 varieties grown for 5 years was from 297 bu. 29 lbs. to 451 bu. 53 lbs. per acre. Nineteen of the varieties gave a yield of over 400 bu. per acre. The leading varieties in average yield for 5 years were Late Puritan, Rose No. 9, Uncle Sam, and Seedling No. 7, all yielding over 430 bu. per acre.

[Field crop work], E. CLIFTON ET AL. (*New Zeal. Dept. Agr., Ann. Rpt., 13 (1905), pp. 228-277, pls. 9*).—Among other work of the New Zealand experiment stations culture tests with various field crops are reported. At the Waerenga Station Connecticut tobacco under shade grew very luxuriantly, the leaves produced being in some instances 1 ft. 10 in. across, well ripened, and of fine texture.

At the Momohaki Station over 100 varieties of potatoes were grown in small plats. The leading variety the last year of the experiments was Northern Star, which yielded over 20 tons per acre, while Imprest Queen ranked first in the average yields for 3 years with more than 19 tons per acre. The boxing of seed potatoes to facilitate planting in backward seasons is described.

The results of fertilizer experiments with Crimson King swede, in which the fertilizers applied represented equal money value, were in favor of 3¼ cwt. of guano per acre, which produced a yield at the rate of 31 tons 3 cwt. Of the smaller applications tested, 2½ cwt. of steamed bone dust per acre gave the best average yields, the results for 9 years showing an average of 28 tons per acre. Notes are also given on the culture of fodder beets and of forage crops.

Annual report on the experimental farms in the Bombay Presidency, 1905 (*Ann. Rpt. Expt. Farms Bombay, 1905, pp. 106*).—Brief reports are given on the work of twelve experimental farms and of the botanical gardens. The experimental work comprised in general culture, variety, and fertilizer tests with millet, Bombay hemp, rice, wheat, cotton, potatoes, and various forage crops, including a number of leguminous plants. A tabular statement showing the field records of a number of hybrid cottons is given.

Department of cooperative experiments, L. H. GODDARD and M. O. BUGBY (*Ohio Sta. Circ. 47, pp. 10*).—The history of cooperative experiments in Ohio is given and a list including the experiments now receiving special attention is presented. The manner in which the work is handled with each individual experimenter is described.

Partial statement of tests offered for 1906 (*Ohio Sta. Circ. 45, pp. 3*).

Proposed constitution and by-laws of the Ohio Plant Breeders' Association (*Ohio Sta. Circ. 46, pp. 3*).

An example of model farming, W. J. SPILLMAN (*U. S. Dept. Agr., Farmers' Bul. 242, pp. 16, figs. 5*).—The subject-matter of this bulletin has been noted from another source (E. S. R., 16, p. 210).

The possibility of diminishing errors in field trials caused by unevenness of soil, G. HOLTSMARK and B. R. LARSEN (*Tidsskr. Landbr. Planteavl, 12 (1905), pp. 330-351*).—In the plan worked out by the author with this purpose in view the field is divided into squares for comparative trials with different varieties, fertilizers, etc.

Every third square is used as a control plat, and in calculating the results the average of the yields on the 3 control plats lying nearest a trial plat is taken into consideration and the difference between this average and the yield of the trial plat determined. This difference is calculated for each trial plat, and the average for all the control plats in the field is also found. The calculated difference for each trial plat is finally added to or subtracted from the average of the control plats, according to whether the difference was positive or negative. The error of the yields obtained for the different plats is represented by the difference between the calculated yields and the average of the actual yields for all trial and control plats.—F. W. WOLL.

Experiments in electroculture, R. LÖWENHERZ (*Ztschr. Pflanzenkrank., 15 (1905), Nos. 3, pp. 137-151, figs. 3; 4, pp. 205-225*).—The work on electroculture by different investigators is reviewed, and the results obtained by the author are reported.

It is concluded that for the purpose of studying the influence of electricity on the growth of plants it is better to make few, but very accurate experiments, than to make numerous tests with different plants. In tests made by the author it was

found that the position of barley grains with reference to the direction of the electric current had a very marked influence upon the electrical effect.

Electrolysis in these experiments had an injurious effect upon the growth of the plants, and it is concluded that this could not have been due alone to the decomposition products formed in the soil by its action, as otherwise the position of the grains with reference to the direction of the current would not have been so marked. The injurious effect of electricity upon plants when the direction of the current was not reversed at all, or only 2 or 3 times during every 24 hours, was no longer noticed when the current was reversed twice per minute.

The influence of lime nitrogen on the germination of the seeds of agricultural plants, B. SCHULZE (*Fühling's Landw. Ztg., 54 (1905), No. 24, pp. 817-822, dgms. 2*).—Experiments were made with wheat, rye, oats, barley, mustard, sugar beets, buckwheat, flax, carrots, and potatoes. The crops were sown or planted at different intervals after an application of lime nitrogen had been made.

The results showed in general that lime nitrogen may affect injuriously the germination and vitality of seed when a sufficient interval of time is not allowed between its application and the sowing and planting of the crop. This injurious influence seemed more apparent on a light sandy soil than on heavier and more fertile soils. It is recommended that lime nitrogen be applied at least from 8 to 14 days before seeding or planting. By this method all danger of injury may be avoided.

Adulteration of Kentucky blue grass and orchard grass seed, J. WILSON (*U. S. Dept. Agr., Office Sec. Circ. 15, pp. 5*).—Of 251 samples of Kentucky blue grass 41 were found to be adulterated with seed of Canada blue grass, and of 265 samples of orchard grass seed 133 were found to contain common seed adulterants, mainly English rye grass and meadow fescue. The samples were bought in the open market and the orchard grass samples were obtained from 24 States. The percentage of adulterants found in the different samples is given in a table.

The value of fertilizer experiments on meadows, T. REMY (*Fühling's Landw. Ztg., 54 (1905), No. 21, pp. 738-741*).—Cooperative fertilizer experiments on meadows conducted for 2 and 3 years in succession are reported, and the variation in the results is pointed out.

The author concludes from the data that in order to find out with comparative certainty the fertilizer requirements of a meadow the experiment should comprise 5 plats, one of which receives nitrogen, potash, phosphoric acid, and lime, while on each of the other plats 1 of these elements is omitted. It is also recommended that the experiments be carried on for at least 3 years in succession, and it is pointed out that duplicate experiments add greatly to the certainty of the results.

The rate of seeding grass seeds, O. GLAERUM (*Akerväkstforsög i 1904. Christiania, 1905, pp. 74-98*).—Conclusions with reference to seeding the common grasses are based on the results of cooperative experiments carried on for over 10 years.

The maximum amount of seed of Norwegian red clover seemed to be between 25 and 30 kg. per hectare, the best results being secured with 25 kg. The maximum amount of Alsike clover was about 30 kg., with the most profitable amounts ranging from 25 to 27.5 kg. per hectare. The maximum, and likewise the optimum, quantities for timothy, orchard grass, meadow fescue, and awnless brome grass were 30, 55, 90, and 90 kg. of seed per hectare, respectively. From 55 to 60 kg. of seed of perennial rye grass per hectare gave the best results.—F. W. WOLL.

The influence of precipitation and temperature on the yield of hay crops, G. HOLTSMARK (*Norges Landbr. Höiskoles Skr., 1905, No. 7, pp. 16*).—The author bases his deductions on observations made during the past 30 years.

The data indicate that either a high average temperature in May and a heavy precipitation during October, or a low precipitation and low temperature in November of the preceding year, and a heavy precipitation during March, a low precipitation and low temperature in May, and a high average temperature in June of the same

year are the most important factors tending to decrease the yield of hay crops. Among the causes tending to increase the yield are a low average temperature and heavy precipitation in May, a heavy precipitation in September, a high temperature and heavy precipitation in November, and a high average temperature in December of the preceding year, and a heavy precipitation in May and June, and a low average temperature in June of the same year.—F. W. WOLL.

Effect of time of cutting on the yield and composition of hay, S. HALS (*Tidsskr. Norske Landbr., 12 (1905), No. 2, pp. 77-83*).—Plats of a third-year timothy and a first-year clover field were cut on 3 different dates in June and July. The quantities of protein secured in the second cutting, when timothy was beginning to bloom and the clover was in full bloom, were higher than in either of the other cuttings. The same was true with reference to phosphoric acid, potash, and lime, but the differences here were only small as compared with the first cutting.—F. W. WOLL.

The protein content of barley and potash manuring, O. REITMAIR (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 11, pp. 983-1014*).—The results of 30 cooperative fertilizer tests with barley are reported and discussed.

In a series of 14 tests made under the direction of the author the crop followed sugar beets on deep, fertile, loam soils. Each individual experiment comprised 2 unfertilized plats in addition to 1 receiving 75 kg. of nitrate of soda and 200 kg. of superphosphate per hectare, and another receiving together with this application 200 kg. of 40 per cent potash salt. The use of nitrate of soda and superphosphate apparently increased the yield per hectare by 216 kg. and the use of potash by 104 kg., but in both cases this increase did not cover the outlay. In 3 of these tests the application of potash seemed to have reduced the protein content, while in the remaining experiments no reduction was apparent.

Similar results were obtained in a second series of 16 tests, supervised by A. Mahner. The author states that in the 30 tests under consideration potash fertilization has not shown the effect of reducing the protein content, but on the contrary, rather a tendency to increase it. It is believed that all other factors of growth, especially total temperatures and moisture, have a greater influence on the quality of the barley than the fertilizer applied.

In over 80 per cent of the tests the addition of potash seemed to have increased the weight of the grain. The results of other experiments indicating that potash fertilization does not reduce the protein content of barley, but does exert a favorable influence on the weight of the grain, are reviewed. In one of these tests the use of phosphoric acid seemed to have reduced the protein content of the barley.

The second part of this report is a refutation of the stand taken by Stoklasa with reference to this problem.

The use of whole and halved fodder beets in seed production, H. BRIEM (*Fühling's Landw. Ztg., 54 (1905), No. 21, pp. 733-738*).—In discussing the subject the author points to an instance in which only 370 out of 2,000 well-formed and heavy selected beets were found rich enough to be used as mother beets.

The sugar content in the entire selection varied from 2 to 13 per cent, and in the beets used for seed the minimum sugar content was 8 per cent. It is held that under such circumstances the maximum production of seed from a single individual is most important, and experiments are reported comparing the yield of seed from individual beets planted whole and when divided into 2 equal parts and planted separately. Forty whole beets of the Mammoth variety produced 6,300 gm. of seed and 40 individuals grown from halves produced 4,900 gm., the relation being as 100 to 155 when the yield of 1 whole beet and 2 halves are taken into consideration.

Corn culture, J. F. DUGGAR (*Alabama Col. Sta. Bul. 134, pp. 169-203, figs. 5, dgm. 1*).—Of 52 varieties of corn tested during the past 10 years Mosby, Cocke, Henry Grady, and Sanders were among the most productive.

The so-called two-eared type of varieties gave larger average yields than the type with the smaller number, but larger-sized ears. Seed of certain varieties from Virginia and Tennessee proved superior to that from Delaware, Illinois, Alabama, and Georgia; but whether this was chiefly due to climate or to more careful selection of the seed corn obtained could not be determined. Early varieties were relatively unproductive, and many of them from northern-grown seed produced a large proportion of unsound corn.

In 6 tests the lower ear used for seed gave a slightly larger yield than the upper ear, but in 2 tests the upper ear gave the better yield. Subsoiling, the depth of the first cultivation, planting in the water furrows, and applying a part of the fertilizer before planting and a part at the second cultivation instead of using it all before planting, did not prove of importance.

Pulling the fodder slightly decreased the yield of grain. The average yields of dry blades was 515 lbs., of cured tops 473 lbs., and of cured stover 1,799 lbs. per acre. Plowing under velvet bean stubble gave an apparent increase of 4.3 bu. per acre, and where the entire growth was used as a fertilizer the first corn crop was increased by 12.3 bu. and the second by 4.4 bu. Where cowpea vines were plowed under 8.9 bu. more per acre was obtained than where only the stubble was used. Plowing under beggar weed which grew after the corn was laid by seemed to have increased the yield per acre by 5.4 bu. Where velvet bean and cowpea vines were plowed under the addition of acid phosphate proved profitable. Nitrate of soda appeared to be a better source of nitrogen than either cotton-seed meal, cotton seed, or barnyard manure.

Iowa's immature corn, C. REINBOTT (*Iowa Agr.*, *6* (*1905*), *No. 1*, *pp. 16–18*).—This article is a synopsis of a thesis on maturity in corn. In the fall of 1904 corn of 3 different grades of maturity was selected on 5 different dates from September 20 to November 7. The samples selected were immature undented corn in the milk, medium mature corn with about one-half of the kernels dented, and mature corn with the kernels dented and glazed. The shrinkage of the samples from the time they were harvested until February 1 is recorded. A very appreciable increase in the amount of dry matter as maturity advanced was observed up to October 13. The immature corn, however, continued to store up matter in the grain for the rest of the period of the experiment.

The effect on the vitality of corn harvested at different stages of maturity was also studied. In thoroughly air-dried husked corn the precentage of strongly germinating kernels increased directly in all cases except one with the maturity. In corn left in the shock until late fall the germination was lowered and varied less regularly than in the husked and dried corn. The immature corn harvested September 20 had shrunken 58 per cent by February 1, and gave 67.7 per cent of strongly germinating kernels. This high germination was due to thorough drying. It is advised to select matured varieties adapted to the locality and to allow the seed corn to remain on the stalk until quite mature, giving it thorough aeration and drying after harvesting.

A study of the effect of dilute solutions of hydrochloric acid upon the radicles of corn seedlings, F. A. LOEW (*Reprinted from Rpt. Mich. Acad. Sci.*, *7* (*1905*), *pp. 50–52*).—The experiments here described show that by growing corn seedlings in dilute solutions of hydrochloric acid the amount of acid is reduced.

The radicles killed in $\frac{1}{256}$ normal hydrochloric acid contained 3.952 per cent of ash, as compared with 7.415 per cent in normal radicles. The ash of the killed radicles contained 2.41 per cent of chlorin and that of the normal 8.96 per cent, while for potash the corresponding figures were 34.17 and 38.76 per cent, respectively. Bacteria and fungi thrived in the solution in which the seedlings were killed, but none were perceptible where seedlings were kept in distilled water for 1 week. The

seedlings killed in $\frac{1}{250}$ normal hydrochloric acid excreted material rich in potassium, and those grown in distilled water also excreted potash or some other alkali.

Since the amount of acid in solutions in which the seedlings were grown was reduced, it is believed that the death was caused by chemical action; and since the killed radicles contained less potassium than the normal ones and the solution in which they were killed was rich in potassium, it is thought that this chemical action takes place between the acid of the solution and the potassium of the radicle. The behavior of bacteria and fungi in the solutions is taken as suggesting that the excretions or extractions caused by the acid solutions might be some organic compound especially nutritious to these organisms.

Cotton growing in Australia, J. BOTTOMLEY (*Melbourne: Mason, Firth, & McCutcheon [1905], pp. 24, figs. 17*).—This is a discussion on cotton growing in Australia, with special reference to a variety originated by crossing a cotton from the upper Amazon region and one from Mexico, both of the Sea Island type. This variety is known as Caravonica, and is described as having a staple very long, strong, and regular and of woolly appearance.

Cooperative potato experiments, 1904, M. WEIBULL ET AL. (*Malmö. Läns K. Hushåll. Sållsk. Kvrtlsskr., 1905, No. 1, pp. 167–206*).—Experiments with 15 varieties of potatoes were conducted on 5 farms.

The highest average yields of tubers for the leading varieties were as follows: Professor Maercker 250, Geheimrat Thiel 247, and Up-to-Date 237 hectoliters per hectare. In starch content Fürst Bismarck led with 22.1 per cent, followed by Professor Wohltmann with 20.6 and Bund der Landwirte with 20.3 per cent. The leading varieties in the production of starch per hectare were Professor Maercker, Geheimrat Thiel, and Silesia, producing 3,570, 3,440, and 3,150 kg., respectively.

Fertilizer tests were carried on with 4 varieties on 20 different farms. Half the number of plats received no manure, while the remaining plats received 250 kg. each of nitrate of soda, 20 per cent superphosphate, and 37 per cent potash salt per hectare, with the exception of certain plats manured in the fall of 1903, which were given 100 kg. less of nitrate of soda and 50 kg. less of superphosphate and potash salt. The results are shown in the following table:

Influence of commercial fertilizers on yield and starch content of potatoes.

Variety.	Without commercial fertilizers.			With commercial fertilizers.		
	Potatoes per hectare.	Starch.		Potatoes per hectare.	Starch.	
			Per hectare.			Per hectare.
	Kilograms.	*Per cent.*	*Kilograms.*	*Kilograms.*	*Per cent.*	*Kilograms.*
Up-to-date	15,760	19.8	3,120	19,960	18.3	3,650
Professor Maercker	15,610	20.5	3,200	19,480	19.5	3,800
Geheimrat Thiel	14,550	20.5	2,980	18,800	19.3	3,630
Silesia	14,370	21.0	3,020	18,740	19.8	3,710

— F. W. WOLL.

Cooperative potato experiments, 1904, H. JUHLIN-DANNFELT and S. RHODIN (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 2, pp. 105–154*).—Variety and fertilizer tests were made. Fifteen varieties were grown on 62 farms in different parts of Sweden. The largest average yields were secured from Paulsen Rothauge, Up-to-Date, Leksand, Mossros, Jämtland, and Cimbal President Krüger. Agnelli, Dolkowsky Topas, Leksand, Paulsen Rothauge, Jämtland, and Up-to-Date, in the order given, produced the largest yields of starch.—F. W. WOLL.

The sprouting of seed potatoes, R. B. GREIG (*Aberdeen and No. of Scot. Col. Agr. Bul. 3, pp. 9*).—Experiments with sprouted seed potatoes were conducted on 9

different farms with 7 varieties and the gain in total crop in favor of the sprouted seed ranged from 18¼ cwt. to 3 tons 1¼ cwt. per acre. In the production of marketable tubers there was a still greater gain in favor of the sprouted seed. Of the varieties grown Northern Star and King Edward VII were the most productive. Directions for the construction of boxes for sprouting seed are given and the advantages and disadvantages of the system are pointed out.

Aerial tubers of the potato, P. DE VILMORIN (*Bul. Soc. Bot. France, 52 (1905), No. 4, pp. 535–537, fig. 1*).—The occurrence of aerial tubers in the potato is reported as being more frequent in varieties with colored than with those of white tubers.

The author observed the production of aerial tubers at different times, especially by the varieties Cardinal, Giant Blue, and American Wonder. They are generally found when the plant has a luxuriant growth as a result of soil moisture. They appear late in the growth of the plant and are located on the lower part of the stems in the axils of the leaves, and correspond to secondary branches hypertrophied and enlarged with reserve material. The occurrence of aerial tubers on two branches originating in the inflorescence of a plant of Giant Blue is described.

The improvement of common varieties of rye in lower Austria, G. PAMMER (*Ztschr. Landw. Versuchsw. Oesterr., 8 (1905), No. 11, pp. 1015–1053, pls. 7*).—Cooperative work in the improvement of common varieties of rye by means of selection is described.

The selection of the breeding material was based upon spike characters representing 4 types. The extent to which the characters were transmitted was observed, and an average of about 50 per cent of the progeny showed the characters of the type. A larger yield was secured from plants with crowded spikes of medium length than from plants with longer and more open heads. The dominance of a particular shape of kernel in an ordinary variety determined the specific character of the grain and it was found that this character was correlated with the prevailing type of spike. It is recommended that for breeding purposes this type of spike be selected because it produces the least variation, gives the highest yields, and thus facilitates the origination of strains adapted to a certain locality.

Within the type it is suggested that that form of the kernel showing the highest percentage be regarded as the basis of selection. In subsequent work only those plants which transmitted this form of the kernel are to be used. It is believed that through this method uniformity in the shape and size of the kernel is most quickly secured and in this way the loss in cleaning grain reduced. This method of selection tends to maintain the type together with its yielding capacity and its fixedness.

The progeny of the plant nurseries under field conditions, although only 1 year removed from the selection of the heads, gave higher yields and grain of better quality than ordinary unimproved rye of the same variety. A pedigreed variety produced more grain and also more straw than an improved strain of this selection, but in quality of grain they were about the same.

Saccharine sorghums for forage, C. R. BALL (*U. S. Dept. Agr., Farmers' Bul. 246, pp. 37, figs. 7*).—This bulletin presents a classification of sorghums, notes the introduction of the crop into the United States together with its area and importance, describes the principle varieties, and gives directions for its culture and uses.

The 4 leading varieties in extensive cultivation are Amber, Orange, Sumac or Redtop, and Gooseneck. The general requirements of the crop are very similar to those of corn, but being a stronger feeder, it will do better than corn on thin soils. A sorghum crop leaves the soil in poor mechanical condition, but it has the advantage of being more resistant to drought than corn and of being also more successful on alkali soils. The crop is grown for pasture, soiling, hay, fodder, silage, and seed. It is especially valuable as a pasture for sheep and hogs as well as a summer and autumn feed for dairy stock. When checked in its growth, prussic acid may form in the leaves and the crop then become injurious when fed to stock. It is best cut for hay

or green feeding from the time of heading until the seeds are in the dough stage. Both the seed and the fodder are rich in carbohydrates, and are best fed in connection with materials containing protein.

The culture of the sugar beet, G. W. Shaw (*California Sta. Circ. 13, pp. 21, figs. 3*).—This circular gives detailed information on sugar-beet culture as practiced in the most successful beet-growing sections. The adaptability of varieties, the kind of soils suited to the crop, the preparation of the soil in the fall and spring, irrigation of beets, and their cultivation and harvesting are discussed.

Experiments . . . sugar beet, G. Clarke (*Chelmsford, England: County Tech. Labs., 1906, pp. 22, pl. 1, figs. 3*).—Cooperative culture tests with 5 varieties of sugar beets were carried on in Essex in 1905 in five different localities. An average yield of 18.3 tons per acre, with 16.7 per cent of sugar in the beet and a purity of 84.7, was secured.

Evaporation by the sugar cane plant, Z. Kamerling (*Meded. Proefstat. Suikerriet West-Java, 1905, No. 87, pp. 22*).—Several experiments in which the water evaporated by the cane plant under different conditions was determined are reported.

In one test with well-developed canes the quantity of water evaporated during 24 hours, when the plants were exposed to the direct rays of the sun only during the afternoon, averaged from 183 to 292 gm. per plant. In another instance a plant of about 6 weeks' growth and exposed to the sun during the entire day evaporated 350 gm. in 24 hours. The average results with 9 different plants 5 mos. old show an evaporation of 1¾ liters of water per day. Further data on the evaporation of water by sugar cane are reported, and it is pointed out that the factors most largely influencing this activity of the plant are the distribution of the roots, physical condition of the soil, soil moisture content, leaf surface, temperature, and sunlight conditions. The effect of the curling of the leaf on evaporation is discussed.

Proceedings of the third annual convention of the Interstate Sugar Cane Growers Association (*Proc. Interstate Sugar Cane Growers Assoc., 3 (1905), pp. 110*).—Among a series of papers bearing on the sugar-cane industry several treat of the culture of cane and its cost of production in different southern States.

Notes concerning seed wheat, G. W. Shaw (*California Sta. Circ. 16, pp. 8, figs. 2*).—This circular reviews previously noted results secured at a number of stations with seed wheat grown on different soils, selected from different sized heads, and separated into large, small, heavy, light, plump, and shriveled kernels. Directions for the prevention of smut by the formaldehyde, copper sulphate, and hot water methods are given.

HORTICULTURE.

The farmer's vegetable garden, J. D. Lloyd (*Illinois Sta. Bul. 105, pp. 152–205, pls. 4, figs. 8, dgms. 3*).—This bulletin presents details of the management of a half acre of ground used as a vegetable garden for 5 years beginning in 1900.

The cost of preparing and maintaining the garden each year, vegetables planted, and the quantity harvested, and their value, have been systematically recorded. The half acre was made in the form of a rectangle and the rows planted lengthwise of the garden and far enough apart to permit horse cultivation. The following table shows the value of the products obtained from the garden for each of the 5 years of the experiment, the total expense each year, and the net profits:

Cost and value of a farmer's garden.

	1900.	1901.	1902.	1903.	1904.	Average.
Value of products	$83.84	$68.47	$124.31	$112.73	$136.81	$105.23
Total expense	32.06	35.06	30.96	28.10	27.73	30.78
Net profits	51.78	33.41	93.35	84.63	111.08	74.85

The following are among the more important conclusions of the author relative to vegetable gardens:

"There is little danger of making the soil too rich for a vegetable garden, for although a total of ninety-eight loads of manure were applied to the half acre during the 5 years, none of the vegetables at any time suffered in point of productiveness by reason of too rampant a vegetable growth. The use of hand tools is unnecessary in the preparation of a seed bed if the soil is worked at the proper time. The labor of hand weeding may be reduced to a minimum by planting in freshly worked soil only, tilling close to the rows early in the season, and permitting no weeds to ripen their seed. The use of a wheel hoe saves labor in the care of a garden, even when much of the tillage is to be done with a horse."

Vegetable growing (*Horticulture, 3 (1906), No. 8, pp. 227, 228*).—Abstract of an address by W. W. Rawson before the Massachusetts Horticultural Society, in which he states that he has found the arc electric light beneficial for the growing of lettuce under glass, and that he is securing promising results by the use of a current of electricity in the soil in his lettuce house.

Quality of vegetables and fruits for the home garden, L. and EFFIE M. BARRON and S. W. FLETCHER (*Country Life Amer., 9 (1906), No. 5, pp. 567–574, figs. 45*).—Illustrations and descriptions are given of what the authors term best-flavored varieties of vegetables and fruits. Cultural directions are given for the varieties, followed by a discussion of the principles of cooking that underlie the best methods for their preparation.

Planting tables for flowers and vegetables (*Suburban Life, 2 (1906), No. 3, pp. 126, 127*).—Tables are given showing when to sow seed, set out plants, distance to transplant, height of plants, and season and color of bloom of 52 kinds of flowers, and the time of planting seed either indoors, in hotbeds, or outdoors, time of transplanting, distance apart in rows and between plants, the amount of seed required, and the time of maturity of 52 kinds of vegetables.

Classified planting list for annuals and vegetables, P. T. BARNES (*Gard. Mag. [N. Y.], 3 (1906), No. 3, pp. 139–141, 155, 156*).—Cultural directions are arranged in tabular form for 10 flowering annuals useful as cut flowers, 6 fragrant-flowered annuals, 6 climbing annuals, 6 annuals that resow themselves, 6 annuals for sunny places, and the same number for shady places, rocky places, sandy soils, heavy soils, very cold climates, 6 annuals that bloom after frost, 6 that resist drought, and 5 everlasting-flowered annuals.

In each case the date of flowering is noted, the color of the flowers, and the height to which they grow. The vegetables are classified as pot herbs or greens, salad plants and sweet herbs, seeds and fruits. Type varieties of vegetables to plant in order to secure a succession throughout the season are given.

Fifty dollars per acre from cucumbers, W. C. COLLINS (*1905, pp. 10*).—This brief pamphlet gives practical directions for the culture of cucumbers for pickling purposes.

Breeding sweet corn—cooperative tests, B. D. HALSTED (*New Jersey Stas. Bul. 192, pp. 30, pls. 4, figs. 8*).—The author has experimented extensively in the cross-breeding of sweet corn, and has sent many samples of the hybrid corns to the farmers throughout the State to grow in cooperative tests with the station.

In the production of sweet corn it is necessary that each variety be planted away from other varieties in order to prevent interpollination. The results of this breeding work has shown that the breaking up in the second and subsequent generations of seed clearly follows the law of Mendel. The bulletin explains this law in considerable detail, and thus indicates to those who are carrying on the cooperative tests the character of the corn they may expect in different generations by planting the different kinds of seeds found on the same ear of hybrid corn.

In crossing Black Mexican on different varieties of sweet corn, black has been found a dominant color. The flinty nature of the grain of "Earliest Table" when crossed on Early Sunrise was a dominant character. Relative to the field-mixing of corn the author states that "should a trucker plant field corn with his sweet every germ cell of the latter fertilized by the field sort would develop into a starchy kernel, but the size of the ears, number of rows and length and breadth of grain are largely determined by the mother plant."

Some experiments were also made in planting kernels from a solid red ear between two rows of white corn. In the resulting crop there was not a single instance of red grains being mixed with white grains, nor were white grains found on any of the red ears produced. Similar results were obtained when the "Striped Evergreen" variety of sweet corn, which has grains more or less splashed with red, was planted under similar conditions. A number of unexpected results obtained in crossing sweet corns are mentioned.

Results of experiments with mushrooms, F. CANNING (*Amer. Florist, 26 (1906), No. 933, p. 610, fig. 1*).—The author grew 5 varieties of American mushrooms in comparison with varieties grown from English and French spawn. The details as to date of spawning, first and last picking, total weight of crop, etc., are shown in tabular form.

The mushrooms were all grown in a bed under the greenhouse benches, an area of 9 sq. ft. bed surface being given to each of the American varieties and 18 sq. ft. to each of the English and French varieties. The heaviest yield was obtained from the American variety Arvensis, 13.9 lbs., followed by Alaska, Columbia, Bohemia, and Dr. Galloway in the order named, the latter yielding but 3.5 lbs. The yield of English spawn was 4.75 lbs. on double the area employed with the American varieties, while the yield from the French spawn was but 0.5 lb. Both the English and French spawn is believed to have been 2 years old instead of fresh spawn.

Canning fruit and vegetables. Preserving fruit juices, E. F. PERNOT (*Oregon Sta. Bul. 87, pp. 14*).—An account is given of experiments extending over 2 years, in the canning of vegetables and fruits, and the preservation of fruit juices for domestic purposes.

In commercial practice canned goods are usually processed to a temperature of 230 to 250° F. for 20 to 30 minutes, as a result of which the tissues of the vegetables or fruits are more or less destroyed and the material becomes mushy, especially after shipping long distances. In the author's work, fresh, clean fruits and vegetables were put in clean cans and covered over with water that had been boiled to sterilize it. The cans were then sealed, after which they were heated to a temperature of 165° F. for 15 minutes. After being allowed to stand 24 to 48 hours, they were again heated as previously and the operation repeated the third time, which completed the process.

Thus treated tomatoes, green beans, wax beans, cauliflower, asparagus, and cherries kept perfectly, and ranked as the highest grade of canned goods. Their natural color, flavor, and texture were retained, and the beans when taken from the can could be broken in the same manner as when fresh. Beans preserved in glass jars were not so satisfactory, as considerable difficulty was experienced in keeping them tightly sealed during the second and third heating. The peas and corn treated in this same manner were a failure, even when processed at a temperature of 212° F. for 20 minutes on 3 successive days, but when processed at a temperature of 240° F. for 30 minutes, kept well, but the product was inferior.

The principle involved in this method of canning fruits and vegetables is that the vegetative cells of the micro-organisms which produce fermentation in canned goods are killed at a temperature of about 160° F. The spores, however, are not killed at this temperature. By waiting a day or so after the first heating many of these spores

germinate. The second heating is for the purpose of killing all the spores that have thus germinated. Should any spores still remain, they will be killed at the third heating. It is absolutely essential that all micro-organisms be killed in order to prevent the spoiling of the canned goods. It is recommended that in canning fruits containing pits the pits be first removed, as there is danger of the pits germinating if kept in a warm temperature. An investigation was made of the organisms which cause the spoiling of corn and peas. In the swelled cans of both these products the same organism was found. It is described as an obligate anaerobe, which readily forms long oval spores situated near the end of single rods, and in microscopical appearance and cultural characteristics is identical with *Bacillus spinosus*.

Experiments were made to determine the thermal death point of this organism and its spores, pure cultures being submitted to different temperatures for different lengths of time, beginning with 160° F. Even after heating to 200° F. for 30 minutes, the material made a strong bacterial growth. Some notes are given on the action of enzyms in canned goods and the micro-organisms which produce poisonous ptomaines. Relative to the reheating of canned goods which have swelled as a result of fermentation, the author states that this material is dangerous and should be thrown away.

In the preparation of sweet cider sterilized beer bottles were filled to the neck with the fresh material and then put into a chest into which steam was turned and the temperature of the material raised to 160° F. for 10 minutes. The bottles were then corked with sterilized corks and tied in, and after 24 hours the bottles were again heated to the same temperature and the operation repeated the next day for the third time. Thus treated the material maintained its flavor without any cooked taste and remained sweet indefinitely. It is stated that the same method may be used in preparing other kinds of fruit juices.

Small canneries in Virginia, R. H. PRICE (*Rpt. Va. Farmers' Inst., 2 (1905), pp. 115–120*).—Estimates as to cost of machinery and supplies for the canning industry, with data as to the number of cans obtained from a bushel of various fruits and vegetables.

Report of fruit experiment stations of Ontario, 1905, L. WOOLVERTON ET AL. (*Ann. Rpt. Fruit Expt. Stas. Ontario, 12 (1905), pp. 80*).—A general report is given by the secretary showing the fruits distributed for testing to all the different fruit stations with an account of visits to various stations, and of the more prominent lines of work outlined for 1906. The report of the instructor of the fruit experiment stations, Prof. H. L. Hutt, is included, together with the papers read at a meeting of the Fruit Growers' Association, and a detailed report of the experimenters at the different stations relative to the different varieties of orchard and small fruits under test.

Fruits recommended for planting in Ontario (*Ontario Dept. Agr. Bul. 147, pp. 11*).—Lists are given of the varieties of orchard and small fruits which succeed best in each of the different districts of Ontario.

Fruit cultivation in Ceylon, H. F. MACMILLAN (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 8, pp. 486–497, pls. 2*).—A general discussion of this subject with specific reference to many of the edible and inedible fruits grown in Ceylon, and illustrations of 51 edible and 69 inedible fruits.

Experiments in orchard culture, W. M. MUNSON (*Maine Sta. Bul. 122, pp. 181–204, pl. 1, dgms. 4*).—A further report is given on the orchard fertilizer experiments reported by the author for the year 1902 (E. S. R., 15, p. 39).

Considerable weakness has been developed in the seedling stocks used, which illustrates the advantage of using some well-known hardy vigorous sort as the foundation of the orchard, rather than miscellaneous seedlings. The main purpose of the experiments is to determine the relative value of cultivation and mulching for orchards with or without fertilizers. Generally speaking, the cultivated trees have made a larger growth than the uncultivated, and those fertilized more than

the unfertilized. Gravenstein mulched and fertilized made slightly larger growth than when cultivated and fertilized.

The average yields have been slightly in favor of cultivation. This was particularly striking in 1905, when an average of 4 bu. per tree was obtained on the cultivated area as compared with 2.8 bu. per tree where mulching was used. The yield on the portions fertilized with stable manure has been slightly heavier than where commercial fertilizers have been applied. In experiments to determine the specific effect of different potash salts on the apple, no noticeable difference has yet developed in the character of fruit or the behavior of trees as a result of the form of potash used.

In 1902, 100 trees in a neglected orchard were set aside for the purpose of determining the best methods of renovation. Pruning, cultivating, and fertilizing have been practiced, and the results on all the plats are very satisfactory. The best results have been obtained where a complete fertilizer was used. On trees which received an excess of nitrogen there was a noticeable lack of color in the fruit, and in 1904 a considerable injury occurred to both fruit and trees as a result of either a too free use of nitrogen or of the absence of potash. Both fruit and foliage dropped and much of the fruit was cracked, while the remainder was as soft and mellow in October as it should have been the following May. Good yields of fruit have been obtained and the author believes that the experiment demonstrates that the off year in the case of Baldwins is an unnecessary condition which ought not to exist in a well-managed orchard.

A specific test is being made of the relative values of the Fisher fertilizer formula for fruits and the station formula. The Fisher formula calls for a mixture of 350 lbs. nitrate of soda, 120 lbs. sulphate of ammonia, 230 lbs. sulphate of potash, 200 lbs. acid phosphate, and 50 lbs. kieserite. These are thoroughly mixed and sown on the surface of the ground under the tree a little farther out than the limbs extend, at the rate of 10 lbs. to a medium sized tree, from May 1 to 10, or as soon as the blossom buds begin to open. The station formula contains about 5 per cent less nitrogen, 2 per cent more phosphoric acid, and 4 per cent less potash and costs about $5 less per ton. Good results have thus far been secured with both formulas but no conclusions have been drawn as yet.

In the top-working of orchards a specific test is being made of the relative value of scions from bearing trees of known value, as compared with scions from nursery trees or miscellaneous sources. This work has been underway two years. Some experiments have also been made to determine the effects of cultivation on the keeping quality of fruit as compared with sod-grown fruit. The results obtained thus far are contradictory.

In the cover-crop work at the station, winter rye has proved most satisfactory on strong land. Where the soil is in need of nitrogen winter vetch (*Vicia villosa*) or spring vetch (*V. sativa*), has proved most satisfactory.

In order to emphasize the importance of rational orchard treatment in other sections of the State, some cooperative experiments have been planned with growers in the vicinity of New Gloucester. This work is briefly outlined. The bulletin contains numerous diagrams showing the arrangement of the various experimental orchards, and tables giving in detail the data secured as to the annual growths of trees on mulched and cultivated areas, and the yields obtained, etc.

Suggestions upon the care of apple orchards, E. WALKER (*Arkansas Sta. Bul. 91, pp. 141-210, figs. 18*).—Suggestions based on the results of experimental work are given for the care and management of apple orchards, including pruning, spraying, fertilizing, cultivation, cover crops, resetting gaps in old orchards, etc.

In rejuvenating an orchard of 27 acres of old bearing trees, good cultivation, pruning, spraying, and the use of both stable manure and commercial fertilizers was given. The work was begun in 1904, and in 1905 534 bbls. of No. 1 apples were

secured, having a value of $2,077.57, and $240 worth of No. 2 culls and vinegar apples total value, $2,317.50, while the expense of production was $883.30. An uncultivated orchard of 30 acres in the same locality yielded, in comparison, but 70 bbls. of poor No. 2 apples. The results of analyses of the soil and subsoil in the orchard rejuvenated are given. They show considerably less than half of the humus normally present in average southern soils. In newer ground the humus was greatest in the surface soil, but in the older land it was greatest in the subsoil.

Attention is called to the injury to apples by the green narrow-winged katydid (*Scudderia texensis*). This insect injured from 3 to 5 per cent of the fruit on many trees. The injury consisted principally in the disfiguring of the fruit. The proportion of sound apples on the area first sprayed in going into the orchard was 93½ per cent; in other parts of the orchard the percentage was 84 to 89 per cent, thus showing that the best work in spraying was done when the men were fresh. The cost of spraying was 3¾ cts. per tree.

Some of the trees were dust sprayed, but the foliage and fruit of these trees were not so perfect as with the liquid. It gave better results against codling moth than against scab, and was very efficient for tent caterpillars. The notion commonly prevalent among orchardists in Arkansas that pruning must not be practiced was found to be erroneous when conducted in a careful and intelligent manner.

The use of nitrate of soda at the rate of 3 lbs. per tree greatly promoted the general vigor of the tree, increased the average size of the apples one-third over trees receiving a general fertilizer, and gave much better results than when only 1 lb. of the same fertilizer alone or with 3 lbs. muriate or sulphate of potash or with 20 lbs. slaked lime was used. "The fruit was not so well colored as that of other trees, and was later maturing. On this clayey cherty soil, very deficient in humus, no marked effects followed the use of the other fertilizers mentioned above, when used separately. Lime seemed to help the foliage and color of the apples on trees treated, while the muriate of potash gave a very bright winesap red to the normally brownish Arkansas, or M. B. Twigs." The resets in the orchard were found to make a good growth when care was given them and sufficient fertilizer to insure plenty of plant food within reach of the roots.

Carbon bisulphid was found an efficient remedy for killing sassafras sprouts when used at the rate of a teaspoonful to a tablespoonful on sprouts 3 to 5 feet tall. It was poured down the stems, beginning 6 inches above the ground. It appeared to kill the roots in all instances. Protection from rabbits was secured by painting the trees with white lead mixed with pure linseed oil.

The most serious harvest injuries to apples were found to come from bruises originating in careless handling by the fruit pickers and in the crushing of the riper specimens by the harder specimens in heading in the barrels. By shaking down the barrels every time a half bushel is put in, and filling only slightly above the chine, this source of injury and loss can be avoided.

The Spencer seedless apple (*Amer. Agr., 77 (1906), No. 7, pp. 206, 207, figs. 3*).—An account of a visit to the seedless apple orchard at Grand Junction, Colo., by W. F. Crowley.

The writer states that this orchard contains about 50 trees from 6 to 12 or 14 years old; that the apples produced are not entirely without seeds at all times; that the apple is a good keeper, and that it will compare favorably in size with the Jonathan and is larger than the Missouri Pippin. In flavor and quality it is placed ahead of Ben Davis and on an equality with many other winter varieties. The claim that the variety is seedless is believed to be well founded. There appears to be a semblance of a core, although not nearly as much as in the ordinary varieties. The apple is hollow in the calyx and it is no longer claimed for it that it is wormless. Under like conditions of storage the apples kept as well as Baldwins.

Experience with plums, H. T. THOMPSON (*Trans. Ill. Hort. Soc., n. ser., 39 (1905), pp. 419-428*).—The author, located in Illinois, finds that Japanese and European plums when grafted on native trees are hardier and better suited to the climate. A table is given showing the time of bloom, size, time of ripening, character of the fruit as to cling or freestone, eating and cooking quality, tendency to rot, etc., for 79 varieties.

Orange culture (*New York: German Kali Works, pp. 68, figs. 14*).—Popular directions for the culture of oranges, including fertilizers, irrigation, protection from frosts, etc. Much of the data contained have been drawn from experiment station sources.

Orange hybrids (*Rural New Yorker, 65 (1906), No. 2925, p. 132, fig. 1*).—Further notes are given on the hybrid between *Citrus trifoliata* and *C. nobilis*, which is characterized by having 5 leaflets. (See E. S. R., 14, p. 442.)

Studies on the banana, L. B. MENDEL and E. M. BAILEY (*Science, n. ser., 23 (1906), No. 583, pp. 333, 334*).—Notes on investigations relative to the influence of various abnormal atmospheres and inert surface coatings on the ripening of bananas.

The normal ripening of the banana is essentially an almost complete conversion of starch into soluble carbohydrate, accompanied by a decrease in the total carbohydrate. When bananas were placed in atmospheres of hydrogen, carbon dioxid, or illuminating gas they failed to produce notable amounts of soluble carbohydrate or to show any considerable decrease in total carbohydrate. Practically the same results were obtained when the surface was coated with such material as paraffin. In an atmosphere of oxygen ripening processes were somewhat accelerated.

"Autolyses with the green pulp, or with the green pulp and scrapings of the inner surfaces of the peel, or of the partially ripened pulp, carried out with toluene water under varied conditions, have yielded negative results. The investigation is being extended in various directions."

The Indian jujube (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 3, pp. 484, 485*).—An account of the uses of the various species of Zizyphus, including Indian jujube (*Z. jujuba*), also known as the wild "ber," and the common Indian jujube (*Z. vulgaris*), the dried fruit of which is an article of commerce.

The fruit of the jujube is used in the preparation of sirups, confections, and lozenges. Its analysis is reported upon by Prof. W. R. Dunstan, of the Imperial Institute. The pulp of the fruit is composed chiefly of sugar with a small part of pectin and extract matters. Specimens of the fruit were submitted to dealers in cattle food with the hope that it might be used in much the same manner as the carob bean, but as it is more bulky and less nutritious than the latter it is not believed that it will become of commercial importance along this line.

The experiment in cocoa curing on the Gold Coast (*Trop. Life, 2 (1906), No. 2, pp. 22, 23*).—This is a brief review of a report by W. H. Johnson, director of the botanical and agricultural department of the Gold Coast, for 1904, in which the results obtained with washed and unwashed cocoa and of varying periods of fermentation are given.

With 12 days' fermentation there was a loss of 27.21 per cent in weight, while with 4 days' fermentation there was a loss of but 11.42 per cent. When a lot of cocoa was sent to Hamburg that which was fermented only 3 days was valued only 1 to 2 per cent lower than that which had been fermented for 6 days, while the former had lost approximately 10 per cent in weight during the process of fermentation and the latter 17 per cent. It would appear from the returns of the brokers that it is advisable to send cocoa to market unwashed, and that a 4 days' sweating is likely to prove the most remunerative.

Annual report of the horticultural and viticultural expert, A. DESPEISSIS (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 6, pp. 531-545*).—An account of the work

for the year, including lists of the varieties of fruit trees most commonly planted for commercial purposes, data on cost of preparing and shipping fruit from Australia to London, the introduction of new varieties of fruits, including oranges, Smyrna figs, date palms, etc., and data showing the yields of various kinds of fruits in different provinces of western Australia in 1904–5 and of the quantities of orchard products imported in 1904. Notes are given on the prevalent insects of the season and on fruit-eating birds.

The cost of fruit packages, packing material, labor in sorting, wrapping, packing, branding, cartage, wharfage, etc., is placed at 83 cts., while the freight to London is 79 cts. The minimum cost of growing a case of apples is placed at 75 cts. Thus, in order to lay a case of fruit down in London and cover expenses the minimum returns must be $2.37.

The influence of the graft on the quality of grapes and wine, and its employment in the systematic amelioration of sexual hybrids, CURTEL and A. JURIE (*Compt. Rend. Acad. Sci.* [*Paris*], *142* (*1906*), *No. 8, pp. 461–463*).—Careful examination was made of the fruits, seeds, etc., of a variety of grapes on its own roots and when grafted on Rupestris. Analyses of the wine obtained from the fruit of the two vines are also given.

The general conclusions are drawn that a graft may modify both fruit and wine. There is an inverse influence between the stock and scion. The action of the graft is not limited to the duration of its association with the stock, but persists in the buds and scions taken from it. This method of asexual hybridization may be used in systematic amelioration of the grape and its hybrids, and especially the wines obtained from them.

The Lincepina grape, M. B. WHITE (*Horticulture, 3* (*1906*), *No. 9, p. 251, fig. 1*).—This new grape, originated by the author, is stated to be a combination of *Vitis labrusca*, *V. vulpina*, *V. lincecumii*, and *V. vinifera*. The mother parent contained the blood of the Delaware, Lindley, and Brilliant. Clinton was the father parent. The grape is of rather dark-red color covered with lilac bloom. "Its clusters and berries are large, and its quality is pure and sprightly, pulp tender to the center, and so transparent that when held up to the light the seeds are plainly seen."

The production of oil of wintergreen, H. D. FOSTER (*Forestry and Irrig., 11* (*1905*), *No. 12, pp. 565–569, figs. 3*).—A description of the process of distilling wintergreen oil from sweet birch (*Betula lenta*). The bark from an average birch 12 in. in diameter is stated to yield 1 lb. of crude oil, worth about $2.25.

Pruning, training, and trimming trees and shrubs, D. G. MCIVER (*London: Dawbarn & Ward, Ltd., pp. 63, figs. 22*).—Popular directions for the pruning of fruit trees and ornamental shrubs.

The book of the winter garden, D. S. FISH (*London and New York: John Lane Co., 1906, pp. XII + 107, pls. 10*).—The author considers the chief winter-berried trees and shrubs from the standpoint of their ornamental usefulness in the winter.

Directions are given for planting and caring for such trees and shrubs and for the care of herbaceous and other winter-flowering plants in the open. Selections for cold and Alpine plant houses are also given. The final chapter deals with the forcing of plants, such as bulbs, shrubs, and roses. Brief descriptions are given of all the various plants mentioned in the work. This is Vol. 26 of the Handbooks of Practical Gardening, edited by H. Roberts.

The lawn, L. C. CORBETT (*U. S. Dept. Agr., Farmers' Bul. 248, pp. 20, figs. 5*).—Popular directions are given for preparing the soil, seeding, and care of the lawn, with a discussion of its relation to walks, drives, trees, and shrubs.

A study of the bibliography and horticultural literature of the past, G. GIBAULT (*Jour. Soc. Nat. Hort. France, 4. ser., 6* (*1905*), *Nov., pp. 710–743, figs. 3*).—A running account is given of all of the more important horticultural works that have

appeared in French literature or that have been translated into the French language from other sources.

The more important antique works are noted, as well as the illustrated works on plants of the sixteenth, seventeenth, and eighteenth centuries. Works dealing with rural architecture, general treatises on gardening, works on fruit culture, floriculture, vegetable garden, and landscape gardening are also noted, as well as old horticultural and botanical catalogues and books of poems, and journals dealing with horticultural subjects.

FORESTRY.

The tree book, JULIA E. ROGERS (*New York: Doubleday Page & Co., 1905, pp. XX + 589, pls. 176*).—This is a popular manual of the trees of North America, and in addition to the indigenous trees, the author has included many of the more important shrubs and also the more extensively introduced species of both groups.

Artificial keys are given which are based upon easily distinguishable characters, by means of which any species of tree or shrub can be identified and its principal characteristics learned. In addition to the usual descriptions, information is given on the growth, habitat, distribution, uses, cultural adaptations, etc. After giving popular suggestions by which the novice may learn to know trees, the author describes the different species enumerated, grouping them according to families.

In the concluding parts of the work notes are given on forestry, the uses of wood, and the life activity of trees. Under the chapters on forestry, the author describes the care of trees, methods of transplanting, pruning, enemies, etc., and the suggestions offered will be found of practical value not only in forestry, but to the amateur planter or owner of a few specimens, as well as to those having charge of parks and street or avenue plantings.

The illustrations, which are an important feature of the work, are mostly excellent reproductions of photographs showing the various aspects of the tree, its leaves, flowers, fruit, etc.

The forest service: What it is and how it deals with forest problems, G. PINCHOT (*U. S. Dept. Agr., Forest Serv. Circ. 36, pp. 24*).—An account of the organization of the United States Forest Service. The service is organized under 7 offices, each of which has several sections. All of the offices and sections are responsible to the forester.

The sections directly responsible to the forester are those denominated inspection, reserve boundaries, publications and education, silvics, forest law, and forest reserves. The other main offices are Forest Measurements, Forest Management, Forest Extension, Dendrology, Forest Products, and Records. The duties performed by each of these offices are briefly outlined. The circular concludes with a classified list of publications issued by the Forest Service.

Previous to July, 1905, the Forest Service was known as the Bureau of Forestry, and earlier still as the Division of Forestry. The Forest Service deals with the practical uses of forests and forest trees in the United States, and first of all with the commercial management of forest tracts, woodlots, and forest plantations. The care and perpetuation of the national forests are under its control, and it offers cooperation and assistance in the solution of practical forest problems confronting either States or individuals.

A working plan for forest lands in central Alabama, F. W. REED (*U. S. Dept. Agr., Forest Serv. Bul. 68, pp. 71, pls. 4, maps 2*).—The working plan presented in this bulletin relates to two tracts of long-leaf pine land in Alabama, one located in Coosa County and the other in the western end of Bibb County and portions of the adjacent counties of Tuscaloosa, Hale, and Perry.

The lumber company for which the plan was made desire to so manage their lands that the area now being cut over will be able to produce at least 3,000 feet to the acre

within twenty-five years, providing it can be done at a profit. The survey work done as a basis for the working plan consisted principally in the running of valuation surveys, making stem analysis, a study of the logging methods now in use on the tract and their effects on the future productivity of the forest, a study of the losses caused by forest fires and means for preventing them, and a special study at the sawmill to determine the value of lumber sawed from trees of different sizes.

The details secured in these surveys and studies are presented in extended form, and include volume and stand tables.

Forestry in Nova Scotia, K. W. WOODWARD (*Forestry Quart., 4 (1906), No. 1, pp. 10-13*).—Forestry conditions in Nova Scotia and the prevailing timber species are noted, as well as the common methods of lumbering. The country is little suited to agriculture, except in the river basins, but is admirably adapted for forestry purposes. White spruce and fir reproduce abundantly and promise to be the main forest trees of the future in that province.

The principal timbers cut up to the present time have been white pine, red pine, red and white oak, spruce, fir, and yellow birch. Hemlock is just beginning to be cut on a large scale. Maple, birch, ash, poplar, paper and gray birch have not as yet been cut commercially. Up to this time no trees less than 12 in. in diameter have been taken commercially. In summarizing, the author states that Nova Scotia demonstrates the practical application of the selection system as regards spruce forests. Profitable cuttings are made annually, yet the productive capacity of the forest is not impaired.

Forestry and forest products of Japan (*Tokyo: Dept. Agr. and Com., 1904, pp. 118*).—This publication is a part of the Japanese exhibit at the St. Louis Exposition. It treats of forests and forest administration in Japan, noting the forest zones and their principal products, yield of forest products, and gives descriptions of the exhibit presented. Fifty-nine per cent of the total area of Japan, or 577,170,000 acres, is occupied by forests. About 21 per cent of the forests of Japan are conifer, 25 per cent broadleaf trees, and 45 per cent conifer and broadleaf trees mixed.

Weight and shrinkage of Japanese woods, K. MOROTO (*Centbl. Gesam. Forstw., 31 (1905), No. 12, pp. 499-502*).—A discussion of the air-dried weight, specific gravity, and shrinkage of Japanese woods, with an account of the uses to which a large number of species are put in the manufacture of furniture, lumber, etc.

The beginning of lumbering as an industry in the new world, and first efforts at forest protection, J. E. HOBBS (*Forestry Quart., 4 (1906), No. 1, pp. 14-23*).—A historical paper on this subject.

The rise in lumber prices, R. S. KELLOGG (*Forestry and Irrig., 12 (1906), No. 2, pp. 68-70*).—The author estimates that the country now uses about 50,000,000,000 ft. of lumber annually, in addition to which the pulp mills take about 2,000,000 cords of wood, the tanneries 1,500,000 cords of hemlock and oak bark, and the railroads about 115,000,000 ties for renewals alone, besides posts, poles, and firewood. For the latter purpose 146,000,000 cords were used in 1880, and it is probable that as much is used at the present time.

The estimated forest area of the United States is placed at 500,000,000 acres, of which four-fifths is in private hands. The well-managed forests of Germany grow on an average about 50 cu. ft. of wood per acre annually, and were our forests equally well managed the supply of wood would just about equal the demand. As a matter of fact, however, the annual growth of our forests is probably not more than one-fifth that of the German forests.

The use of wood pulp for paper making, S. C. PHILIPPS (*Jour. Soc. Arts, 53 (1905), No. 2739, pp. 700-719*).—An article dealing comprehensively with the various phases observed in the preparation of wood pulp for paper making, including a discussion of the various processes of disintegrating the wood, chemical pulp, and the various uses to which wood pulp is put. Statistics are given upon the pulp imported

into Great Britain during April, 1905, and its value; also the imports for the years 1901–1903. The article has also been published as a separate (Calcutta, Superintendent Government Printing, 1905, pp. 34).

A new saving in the turpentine industry (*Forestry and Irrig., 12 (1906), No. 2, pp. 99, 100*).—Further economy has been effected by the Forest Service in the turpentine industry as the result of experiments carried out during the past season, which indicate that at least an equal flow of resin can be secured from shallower and shorter "faces." It is believed that with this diminution in the severity of the facing operation the ordinary term of 3 or 4 years during which a forest is now worked can be greatly increased.

Report of the committee of 1905 to consider the laws relative to the taxation of forest lands (*Mass. Forester's Off. Bul. 3, pp. 28*).—A synopsis of the laws of the various States and countries on this subject.

Efficient fire protection, A. B. Recknagel (*Forestry Quart., 4 (1906), No. 1, pp. 1–4, figs. 2*).—Details are given of the organization and methods followed in the policing of a tract of 14,000 acres of hard wood in northeastern Pennsylvania at a cost of about $1,710 annually. Each patrolman is provided with an axe, pail, hoe, and shovel. Engines operating on the track are fitted with double spark arrestors in summer. On a convenient siding a tank car of 4,970 gal. capacity has been rigged with hose and double pump as a fire engine.

Results of a Rocky Mountain forest fire studied fifty years after its occurrence, W. J. Gardner (*Proc. Soc. Amer. Foresters, 1 (1905), No. 2, pp. 102–109*).—A report on an examination of the condition of the forests on the southern portion of the Pikes Peak Reserve to determine to what extent the denuded slopes of this watershed are naturally reforested.

The region comprises nearly 79 square miles of extremely rugged mountain land. More than 56 per cent of the district is above 9,000 ft. Three and one-half square miles lie above the timber line. The prevailing forest types are Engelmann spruce, limber pine, red fir, and bull pine. Early in the investigation evidence was obtained to show that a portion of the region had been severely burned about 50 years previously. The reproduction of the forests since that time has been slow and irregular. In some places the new growth is exceedingly dense and in others the ground is still perfectly bare.

Relative to the aspen as a nurse-tree, it was observed that Engelmann spruce, red fir, and other species came in after the fire quite regardless of aspen, though it is stated that wherever the aspen does occur it undoubtedly acts as a valuable soil protector. Where the new growth occurs, Engelmann spruce is most abundant; three-fourths of the young trees of this species was found to be 30 to 50 years old, but comparatively little young growth has started within the past 30 years. The spruces grow extremely slow, trees 2 to 4 ft. tall and 40 to 45 years old being quite common. On an average it is estimated that it takes an Engelmann spruce 25 to 35 years to reach a height of 5 ft. in that region. Most of the diameters are below 2 in. It is stated that the tolerance of Engelmann spruce is remarkable, as trees in old crowded pole forests sometimes persist for 200 to 250 years without attaining a height exceeding 10 to 15 ft.

Investigations on the influence of forests on the ground water table, A. Bühler (*Forstw. Centbl., n. ser., 28 (1906), No. 2, pp. 112–119*).—This is a rather extended review of a 17 quarto page pamphlet written by Dr. Ebermayer and O. Hartmann, and published by Piloty & Löhle, München, 1904, in which an account of 3 years' investigations on the influences affecting the height of the water table were studied. The more important conclusions are stated as follows:

The storing of the ground water is dependent first of all upon the seasonal distribution of the rainfall. Other important factors are the size of the storage basin, the degree of dryness of the soil, the thickness, permeability, and inclination of the

water-bearing strata, and finally the use of water by growing plants. Because of the smaller amount of evaporation and the greater absorption of the soil, the storage of ground water is considerably greater in the winter than in the summer. The influence of forests on ground water can not be measured where the water-bearing strata is inclined, thus giving rise to stream flow.

In the climatic zone of Bavaria, where these experiments were carried on, forests had no effect either on raising or lowering the ground water. It is desired that this conclusion be considered local and as applying to more or less permeable soils. A brief review of other similar work is included.

Rubber, gutta-percha, and balata, F. Clouth (*London: Maclaren & Sons; New York: D. Van Nostrand Co., 1903, pp. XII+242, figs. 30, maps 2, dgm. 1*).—This is the English translation of this work, which first appeared in German in 1899. It contains chapters on the natural history, production, and commercial points of rubber, gutta-percha, and balata, and on their chemical and physical properties. In the case of rubber, there are chapters also on the production of soft rubber goods, vulcanization, hard rubber, and regenerated and artificial rubber. The production and employment of gutta-percha goods is also considered, as well as the principal products made of India rubber, gutta-percha, and balata.

Rubber tapping on Kepitigalla estate, I. Etherington (*India Rubber World, 33 (1906), No. 4, pp. 107–112, figs. 7*).—This estate is considered a typical example of a well-worked plantation of cacao and *Hevea brasiliensis*. The methods of tapping in vogue are explained, and descriptions given of the coagulating factory and machines for coagulating the latex. The spiral method of tapping is described in detail and illustrated.

By this method of tapping the average yield per tree for the preceding year was little over five pounds of rubber. There is very little scrap with this system, and the rubber turned out is of very high grade. It is believed that this system will be widely taken up on plantations, as it is considered one of the most important forward steps made in the industry for considerable time.

A new tapping method for Kickxia elastica, Strunk (*Tropenpflanzer, 10 (1906), No. 3, pp. 141–149, figs. 6*).—In place of the herring-bone method of tapping, the author uses simply perpendicular slits placed about 10 cm. apart.

The yield of rubber obtained is claimed to be fully as great and the trees are much less injured. The yield of rubber is increased if the slits are made at intervals of about 4 weeks. The old slits are not reopened until after several years, when they are completely healed. It is believed that by this method of tapping the work can be much more rapidly performed and the profits considerably increased. Illustrations are given showing the methods of tapping followed and the tools used for making the cuts.

Report on the experimental tapping of Para rubber trees in the botanic gardens, Singapore, for the year 1904, H. N. Ridley and R. Derry (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 11, pp. 424–443, pls. 2*).—Experiments have been carried on with 84 groups including 880 Para rubber trees during the past year. These trees produced a total of 884.5 lbs. of dry rubber.

Various methods of tapping have been investigated. The single incision method is quickly performed, but gives only about one-half the product obtained by the herring-bone method. Trees tapped with the single incision do not recover well and the bark is made difficult for any other method of tapping. It is noted that trees tapped late or early in the year are the slowest to recover. Para rubber trees apparently make their most rapid growth between the sixth and fifteenth years of life, making an annual increment of growth in the trees under observation of 3 to 6 in.

Closely planted trees do not make satisfactory increment of growth, and the yield of rubber increases with the size of the tree from under 0.25 oz. of dry rubber to the inch of girth for small trees to over 0.5 oz. for large ones. This point is further

brought out in some data in which it is shown that 40 tapped trees, averaging 2 ft. 3 in. in girth per tree, produced 18.4 lbs. of rubber, while 20 trees averaging 4 ft. 2 in. in girth yielded 25.4 lbs. of rubber. In another instance 50 trees averaging 1.75 ft. in girth yielded 18.5 lbs. of rubber, while only 15 trees, 5.6 ft. in girth, yielded 33.5 lbs. of rubber.

Extensive tables are given showing the yield of rubber from morning and evening tappings and by different methods of tapping, and growth of different trees under observation. Morning tappings have produced more rubber than evening tappings.

Note on the germination of teak and other seed, R. S. Pearson (*Indian Forester, 31 (1905), No. 11, pp. 635-638*).—The germination of teak seed was seriously injured by abnormally heavy falls of rain. Dhawra seed (*Anogeissus latifolia*), which the author heretofore has been unable to make germinate, was successfully germinated by sowing the seed on well irrigated raised beds, the soil being mixed with a large quantity of coarse sand, the seed sown in June and daily watered by hand. The germination was greatly facilitated by covering the bed with a thick layer of leaves and branches about 18 in. above the ground.

The teak timber trade of Burma, T. A. Hauxwell (*Indian Forester, 31 (1905), No. 11, pp. 618-635*).—The teak timber trade of Burma is shown to be steadily decreasing, while that of Siam is gradually increasing. The causes of this decrease are discussed, chief of which are the diminution in the supply of old girdled timber of large size in Burma, less accessible areas, the increase in the cost of elephants necessary for the work, more rigid requirements as regards working, and increased rate of royalty demanded. Tables are given showing the total output of teak in Burma for the years 1887 to 1904, and of exports of teak from Burma and Siam during approximately the same period.

DISEASES OF PLANTS.

The physiology of diseased plants, L. Montemartini (*Atti Ist. Bot. Univ. Pavia, 2. ser., 9 (1904), pp. 63; abs. in Bot. Centbl., 98 (1905), No. 11, pp. 276, 277*).—A study was made of the respiration, assimilation, transpiration, increase in dry matter, ash, etc., in a number of plants that had been attacked by various plant and animal parasites. Among the plants investigated were grapes, violets, clematis, various grasses, roses, quince, euonymus, etc., the fungi being rusts, mildews, and leaf spots, and the insect attacks being due to mites.

The different parasites studied are said to be able to exert a stimulative effect on the development of their host plants. This is manifest more in the increased respiration than in chlorophyll assimilation, the latter being depressed as respiration is increased. In general the Uredineæ excite a greater chlorophyll assimilation on the part of the host. Transpiration was found uniformly greater in diseased than in sound plants, with the exception of euonymus attacked by *Chionaspis euonymi*. The transpiration under the action of light is increased for a time, after which it markedly diminishes. It also increases whenever assimilation is stimulated. Most of the parasites studied did not seem to have any direct influence on the water or ash content of their hosts, and whatever increase was found was attributed indirectly to the stimulated physiological activity of the plant.

Attention is called to the fact that many poisons exert stimulating effects on plants when dilute, although they are destructive when used in greater proportions. From this the author deduces the hypothesis that the parasites may secrete some poisonous substances, possibly zymases or oxydases, which at first have a stimulating effect on the host plant and which disappear with the progress of the disease.

Plant diseases of Belgium, H. Vanderyst (*Bul. Agr. [Brussels], 21 (1905), Nos. 4, pp. 583-632, figs. 12; 5, pp. 873-908, figs. 7*).—After a general account of the Ustilagineæ, in which their common host plants are enumerated, the life cycle of

the fungi and means for their repression are described. The author takes up the various genera of smuts, describing their species in detail. The work is intended as an account of the diseases of Belgium which are due to fungi, but a considerable number are included that have not yet been reported as occurring in that country.

Annual report of investigations on plant diseases, M. HOLLRUNG ET AL. (*Jahresber. Pflanzenkrank., 7 (1904), pp. VIII + 374*).—A review is given of the literature relating to plant diseases and insect injuries during 1904, about 2,000 articles being noted by abstract or otherwise. The arrangement is similar to that in previous publications (E. S. R., 17, p. 373).

The bearing of Mendelism on the susceptibility of wheat to rust, E. J. BUTLER (*Jour. Agr. Sci., 1 (1905), No. 3, pp. 361-363*).—Commenting upon the conclusions of a previous author (E. S. R., 17, p. 462), the author states that the Mendelian laws may hold good for a given rust in a particular locality, and not where the wheat is exposed to the attacks of a second species of rust or when it is transferred to another locality. A number of instances are cited of varieties of wheat that are reputed to be resistant to rust in one locality which are quite easily affected when transferred to other regions, and vice versa.

The author in defining susceptibility to rust says that it depends on the liability of the leaves to uredospore attack, and that the latent germ, if it exists at all, can do so only in a comparatively small proportion of grains. No wheat is as yet known on which rust may not sometimes appear, so that immune sorts may bear the latent germ as well as susceptible ones.

Experiments with wheat and oats for smut, L. F. HENDERSON (*Idaho Sta. Bul. 53, pp. 15*).—The use of fungicides for the prevention of smuts of wheat and oats has been commonly urged, and the present bulletin was designed not to test the relative efficiency of treatments but to find out, as far as possible, how long grain should be treated to give the best results. It is shown that smut may be controlled by proper treatment, and that formalin solution is better than copper sulphate. Another season's experiments will be required to determine whether the yield per acre is sufficiently greater with oats treated with hot water to pay for the extra trouble over the formalin treatment.

A second series of experiments was carried on to determine the effect of formalin on germination of grain. To test this, wheat was piled upon heavy canvas, thoroughly sprinkled with formalin solution, and shoveled until every kernel was wet, after which the pile was covered with two thicknesses of canvas and allowed to remain for some time. The seed treated with a solution of 1 pt. of formalin to 16 gal. of water and covered for nearly a day was but slightly injured. The seed treated as above and covered for nearly 2 days was seriously affected. Wheat treated by the ordinary formula, 1 pt. of formalin to 50 gal. of water, or even 1 pt. to 25 gal., was not injured at all, although covered for 2 days. It is recommended that in treating grain with formalin the piles should not be covered at all. Injury is believed to be due either to the use of too strong solutions or to the covering of the pile so as to keep the seed moist for 2 days or more.

The flag smut of wheat, D. McALPINE (*Jour. Dept. Agr. Victoria, 3 (1905), No. 2, pp. 168, 169, pl. 1*).—A description is given of attacks of *Urocystis occulta* on wheat. This smut is usually confined to rye, but in Australia seems to be a rather serious pest of wheat. For its prevention the author recommends the use of formalin, the seed to be soaked for 10 minutes in a solution of 1 lb. to 40 gal. of water, after which it is dried and sown.

Potato scab, L. F. HENDERSON (*Idaho Sta. Bul. 52, pp. 8*).—A report is given of a series of experiments to test the relative value of sulphur, formalin, and corrosive sublimate treatments for the prevention of potato scab.

Rolling seed potatoes in sulphur was found to have little if any effect in reducing the amount of scab, and treated potatoes planted in soil from which a scabby crop

was removed the previous year resulted in the production of a scabby crop. Treatment with formalin gave as good results as with corrosive sublimate; and as it is much safer to use than corrosive sublimate, formalin is recommended. The treated potatoes should be planted in new ground and care should be exercised that after treatment they should not be placed in sacks which have previously held scabby tubers.

Potato leaf curl, M. C. COOKE (*Gard. Chron., 3. ser., 38 (1905), No. 978, p. 230*).—The author states that the potato leaf curl, or early blight, as it is known in this country, caused by *Macrosporium solani*, while previously noted, has only recently become a serious pest in England. The appearance of the fungus and its effect upon the host plant are described, and, according to the author, the only conidia commonly occurring in the British specimens are those of the Cladosporium form.

Spraying with ammoniacal copper carbonate or dilute Bordeaux mixture, if commenced sufficiently early, will hold the disease in check.

The cytolytic enzym produced by Bacillus carotovorus and certain other soft rot bacteria, L. R. JONES (*Centbl. Bakt. [etc.], 2. Abt., 14 (1905), No. 9-10, pp. 257-272*).—In an account of studies on the soft rot of the carrot previously noted (E. S. R., 13, pp. 362, 567) the author suggested that the possible action of the bacteria was through the presence of a cytolytic enzym, and the correctness of this supposition has been confirmed by subsequent investigations.

The author believes, as a result of his studies, that the action of the organisms on the tissues of the host plant is shown in the solution of the middle lamellæ of the parenchymatous tissues, and that the organisms do not pass through the undissolved residual walls. The action upon the cell walls being determined as enzymic in nature, he undertook to isolate and study the characteristics of the enzym, separating it by heat, filtration, the use of germicides, diffusion, and precipitation with alcohol. The methods pursued are described at considerable length, after which an account is given of the relation of various conditions to the activity of the enzym. The enzym seems to be a stable compound which persists unchanged for a long time in culture broths and may be preserved indefinitely as a dry precipitate. It is most active at temperatures ranging from 40 to 45° C., and when the temperature was carried to 51° or more the enzym was destroyed in all solutions. Other characteristics of the action of the enzym are described, and comparisons were made between its action and a similar cytolytic action observed with other organisms.

The author has had under observation about 40 strains of organisms isolated in different laboratories from the rotting tissues of cabbage, turnip, cauliflower, kale, iris, etc., and comparative trials have shown that these soft rot organisms, although from different vegetables and widely separated regions, are remarkably similar in enzymic activity. The only exception observed is that found in *Pseudomonas iridis*, which, in the author's opinion, is nonpathogenic under the conditions observed. The others all induce soft rots of various vegetable tissues, and from the cultures of each a cytolytic enzym was secured that was indistinguishable from that produced by *B. carotovorus*. In all of these the action consists in the solution of the middle lamella and ceases before the complete solution of the cellulose layer of the wall, and in all there was an absence of any diastatic action.

The author comments on the classification and nomenclature of cytolytic enzyms, showing the present tendency to use the words pectinase and cellulase vaguely as synonymous with cytase. The author suggests that they be restricted to more exact usage and that cytase and cytolyst be retained as convenient and satisfactory terms for use in the broader sense to include in general all enzyms capable of hydrolyzing the cell walls.

Cactus scab, G. MASSEE (*Gard. Chron., 3. ser., 38 (1905), No. 972, p. 125, fig. 1*).—A disease caused by a parasitic fungus has long been known to cultivators of cacti,

but until recently the fruiting form had not been recognized. A recent investigation showed the parasite to be *Diplodia opuntiæ*, first collected on *Opuntia nana*, in Northern Italy. The injury caused by the fungus is sometimes severe, the black minute, wart-like outgrowths often covering a considerable area and the surrounding tissue becoming discolored.

Constitutional diseases of fruit trees, A. G. CAMPBELL (*Jour. Dept. Agr. Victoria, 3 (1905), No. 6, pp. 463-465*).—Brief descriptions are given of a number of diseases of apples and apricots, which, so far as known, are not due to the presence of any parasitic growth.

The diseases described are watercore, bitter pit, and crinkle, a name given a rather serious disease of the apple, in which the cells just beneath the skin, particularly about the calyx, die and collapse, causing a sunken, discolored area. Some varieties seem especially subject to this disease, the Rome Beauty being particularly liable to this trouble. The disease of apricots described under the name smudge is characterized by the death of the cells in large irregular patches, over which the skin sinks, leaving dark blotches on the surface.

For the successful treatment of most of these troubles attention should be paid to the proper cultivation of the trees, drainage, fertilizers, etc.

Black spot canker and black spot apple rot, W. H. LAWRENCE (*Jour. Mycol., 11 (1905), No. 78, pp. 164, 165*).—The black spot canker fungus (*Macrophoma curvispora*), like the bitter rot fungus, causes a disease of both the tree and fruit. It differs, however, from bitter rot in that the canker stage does by far the greater amount of injury. This stage has become very prevalent in certain parts of British Columbia, Oregon, and Washington, causing considerable loss.

In January, 1903, the author noticed numerous decaying apples among stored fruit, in which a few pustules were present in decaying areas, and later the epidermis overlying each pustule split, exposing a mass of creamy white spores. These spores were identical with those previously recognized as typical of the black spot canker fungus except that they were slightly larger. Inoculation experiments were carried on to determine the relation of the canker and the rot, and it was found that the fungus is parasitic in the bark and sapwood of the trunk and branches and also on the stored fruit of the cultivated apple.

The first indication of the presence of the disease in the fruit is a slight discoloration of the flesh of the apple just beneath the epidermis. The flesh becomes a light brown color and as more becomes involved the color changes to a deep brown. The epidermis takes on a corresponding change of color, and the decaying spots become depressed, dry, and leathery. In many cases the decaying areas are found near the basin and calyx ends of the fruit, being associated with codling moth burrows, bruises, etc., but more than 50 per cent of the specimens examined showed that the fungus entered directly through the epidermis of the fruit.

Moisture and temperature were found to exert marked influence on the development of the rot. In cool, dry weather the spots increase in size, but few pustules are developed. During cool, damp weather an abundance of pustules is formed. The tendency for certain varieties of fruit to decay more rapidly than others was observed.

A technical description of the fungus on both the tree and the fruit is given, based upon the author's observations.

Pear blight, cause and prevention, R. I. SMITH (*Ga. Bd. Ent. Bul. 18, pp. 109-126, pls. 2*).—According to the author, pear blight in 1905 caused an unusual amount of injury in both pear and apple orchards, in some localities practically destroying the crop, while in others from 50 to 75 per cent of the blossoms were destroyed by the form of the disease known as blossom blight. By special arrangement with this Department cooperative experiments are being carried on in the nature of demonstration work to show the possibility of controlling this disease.

An account of the cause and prevention of pear blight, by M. B. Waite, is given, the article being copied from the Yearbook of this Department for 1895 (E. S. R., 8, p. 796). The bulletin concludes with a brief account of the leaf blight of pear and quince, caused by the fungus *Entomosporium maculatum*.

A new disease of olives, A. MAUBLANC (*Bul. Soc. Mycol. France, 20 (1904), pp. 229-232, figs. 7; abs. in Bot. Centbl., 98 (1905), No. 12, p. 299*).—A brief account is given of a disease of olives due to *Macrophoma dalmatica*. This fungus forms its pycnidia in brown spots on the surface of the fruit, which extend to the center, resembling in a way the puncture of insects. The fruit in the process of its development isolates these diseased areas by forming about them a corky layer.

Some causes of the destruction of vines in Tunis, L. RAVAZ (*Bul. Agr. Algérie et Tunisie, 11 (1905), No. 19, pp. 434-443*).—A report is given of the investigations of a commission appointed to determine the cause of the rapid destruction of grapevines over quite an extended area in Tunis.

Studies made in the vineyard and laboratory failed to show the presence of any fungus or other organism, and the author finally concluded that the trouble was chiefly due to the heavy overbearing of young vines, and the history of a number of vineyards tended to confirm this conclusion. Under the condition of grape growing in Tunis 3 and 4 year old vines produce such abundant crops that the vines are permanently weakened and finally die. The author suggests the removal of all dead stocks, replacing them with new ones, and by attention to culture, the use of fertilizers, and irrigation during the first few years after planting the losses attributed to this trouble can be avoided.

Studies on the gray rot of grapes, G. DE ISTVÁNFFI (*Ann. Inst. Cent. Ampélol. Roy. Hongrois, 3 (1905), No. 4, pp. 183-360, pls. 8, figs. 15*).—The results of an extended series of biological and mycological studies on *Botrytis cinerea* or *Sclerotinia fuckeliana* are given.

Germination experiments are reported upon at length, in which the normal germination of the fungus is described and the effect of various physical agents and chemical compounds shown. The author gives a general account of the sclerotia of the fungus, describing their growth on different parts of the vine, behavior in pure cultures, etc., as well as practical suggestions for combating the disease, which at times becomes epidemic in its nature. In the studies reported the polymorphism of the fungus is shown and the different forms of growth and reproduction are described. The author has traced the life cycle of the fungus, adding a number of important discoveries relating to it.

Among considerations of practical importance in combating the disease, the author says that the Botrytis form of the fungus lives saprophytically on fallen leaves, twigs, fruits, etc., during the early season, but the conidia develop with great rapidity on the arrival of warm, moist weather, and when transferred to the growing foliage, live parasitically. The Botrytis attacks the ripening fruit in autumn, often causing great loss. Sclerotia are formed abundantly on the grapes and also on the cuttings made during the summer. If the fungus is present upon the cuttings when stratified the disease will be carried over the winter. The mycelium is also able to pass the winter in the young shoots, so care should be exercised in selecting cuttings either for layering or grafting that they are not affected.

In stratifying cuttings the author recommends wetting the twigs, sand, benches, boxes, etc., with a 5 per cent solution of calcium bisulphid, after which all are to be well dried in the sun before being packed away. In the spring of the year the sclerotia can easily be found on the fallen leaves, twigs, dried grapes, etc., where they germinate about June 1. All débris in vineyards should be collected and burned in the autumn. Thoroughly washing the vines with a 5 per cent solution of calcium bisulphid during late autumn or early spring, and alternate applications during the growing season of 1 per cent solutions of Bordeaux mixture and powdered sulphur

with powdered bisulphid of soda are recommended as preventive treatments. The application of dry fungicides is said to be preferred to ordinary sprayings as being less liable to scatter the spores of the fungus.

The must from diseased grapes should receive the same treatment as is recommended above for cuttings and dried fruits.

Experiments in controlling black rot in Loire, L. ROUGIER (*Rev. Vit., 24 (1905), No. 628, pp. 713-719*).—Descriptions are given of a number of experiments carried on for the prevention of black rot of grapes. The use of acetic acid added to fungicides has been recommended, and the author undertook to determine the amount of this acid that would be dangerous to plant growth. It was sprayed upon grapes in various concentrations alone and with neutral copper acetate. As a result of the investigations the author finds that the disease could be successfully controlled by the use of an acidulated copper acetate.

A new disease of grapes, G. DE ISTVÁNFFI (*Ann. Inst. Cent. Ampélol. Roy. Hongrois, 3 (1905), No. 3, pp. 167-182, pl. 1*).—In 1900 a disease of grapes was observed in Hungary that superficially resembled an attack of black rot on the foliage. An examination showed that it was in no way associated with the black rot, but was due to a distinct fungus, *Phyllosticta bizzozeriana*. Since its first observation the disease has spread, but most injury is noted in the original center. The fungus attacks the leaves only, never being observed on the fruit, and it has no relation to the black rot, but is often associated with the anthracnose, the two fungi seeming to work together.

Frequent and thorough treatment with fungicides such as are recommended for grape mildew is suggested, and on account of the association with anthracnose, late autumn and early spring treatments for preventing anthracnose are advised. All European varieties of grapes as well as the variety Isabella seem subject to attack. A technical description of the fungus is given, and its relation to other species of Phyllosticta is discussed.

The bud rot of cocoanuts, J. H. HART (*Trinidad Bot. Dept., Bul. Misc. Inform., 1905, No. 48, pp. 242, 243*).—A summary is given of the author's observations regarding the bud rot disease of cocoanuts. The evidence presented seems to indicate that the disease has been present on the plantation examined for a great many years, as there is a succession of trees which have been planted on areas vacated by the destruction of former occupants.

A preliminary microscopical examination showed bacteria present in great quantity, especially in the heart or growing portion of the tree. The specimens examined were found to be infected from the ground upward, and when the stem was cut through a ring of red discoloration was found between the woody exterior and the interior parts of the stem. This discoloration became more prominent as it reached the growing points and appeared especially to affect the base of the leaf stalks and the spathes inclosing the flowering organs. Eventually these portions become badly infested, the leaves fall, and the tree dies.

From previous descriptions of diseased cocoanut trees from various sources the author believes that there is little doubt as to the identity of the disease under examination. So far he has been unable to find that there was any relation between the occurrence of the disease and the injury done by the palm beetle (*Rhyncophorus palmarum*). In addition to bacteria, numerous fungi are to be found in the diseased stems, and further investigations will be necessary to determine the true cause of the disease and methods for its control.

Cacao diseases (*Bul. Dept. Agr. [Jamaica], 3 (1905), No. 12, p. 270*).—A brief account is given of the disease of cacao due to the fungus *Phytophthora omnivora*. The presence of this fungus may be recognized by the darkening of the pods and the occurrence of a delicate white mold on the outside.

To prevent the disease it is suggested that the affected pods be gathered and burned, or so deeply buried that the spores will not be brought to the surface. In order to prevent spread to other pods the trees should be well sprayed with Bordeaux mixture.

The cocoa disease in Surinam (*Trop. Life, 1 (1905), No. 1, p. 12*).—A brief account is given of the spread of the cacao disease in the West Indies, and a letter from Dr. Van Hall is noted, in which it is stated that the witch-broom disease has been under investigation by him for about 9 months, but as yet he has been unable to ascertain definitely the means of its dissemination. It is believed probable that the spores are spread principally by the wind. Dr. Van Hall states that while the disease first appeared in Surinam, it is now known as occurring in Demerara, where it is spreading, and will probably cause great loss. In Surinam this disease has reduced the export from 31,630 bags of 100 kg. each in 1901 to 8,540 in 1904.

The silver-leaf disease (*Gard. Chron., 3. ser., 38 (1905), No. 971, p. 111*).—A brief note is given on inoculation experiments carried on by Professor Percival at Reading.

If by a process similar to budding a small fragment of the fungus or portion of the leaf affected with the characteristic discoloration be inserted in the bark of plum trees, after some time, varying according to season, the silvery appearance shows itself in the foliage where before all was green. This peculiar appearance is due to the detachment or raising of the epidermis of the leaves from the adjacent tissue. So far no fungus has been found in the leaves, and it is intimated that probably the disturbance is caused by some ferment or enzym secreted by the fungus, which reaches the leaves from the wound.

The disease seems to be confined to the stone fruits, and it occurs under glass as well as in the open air. The only remedy at present known is to cut away the affected branches and induce the tree to make new growth, but experiments have shown that this is not at all satisfactory.

Combating the pine leaf cast, SCHALK (*Forstw. Centbl., n. ser., 27 (1905), No. 11, pp. 561-570, pl. 1*).—The pine leaf cast, due to the fungus *Hysterium pinastri*, is described and notes given on experiments carried on for its control.

The author claims that even in regions where the disease is very prevalent it can be prevented by thorough spraying and the proper use of fertilizers. A single annual spraying in the seed bed will usually be sufficient, and if carried on for 4 years strong plants will be produced and the dominant ones will be free from disease. In the nursery rows at least 2 sprayings should be given the trees annually. This, together with proper fertilizers, will enable the young plants to withstand the leaf cast.

Winter treatment against fungus diseases, L. DEGRULLY (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 49, pp. 641, 642*).—The author points out editorially the advantage to be obtained by the use of strong solutions of fungicides as winter treatment against various grape diseases, and he recommends treating the vines during the dormant season with strong solutions of potassium sulphate, calcium bisulphite, and iron sulphate for the prevention of powdery mildew, or with solutions of copper sulphate and bichlorid of mercury for preventing downy mildew, black rot, and powdery mildew.

Fungicides and their use in preventing diseases of fruits, M. B. WAITE (*U. S. Dept. Agr., Farmers' Bul. 243, pp. 32, figs. 17*).—The object of this bulletin is to give the principal formulas for fungicides, together with brief descriptions of their methods of preparation, and a summary of the principal diseases of fruits for which satisfactory remedies have been found.

ENTOMOLOGY.

Proceedings of the Entomological Society of Washington (*Proc. Ent. Soc. Wash., 7 (1905), No. 2-3, pp. 65-152, figs. 12*).—In this number the following papers are included:

Descriptions of New American Spiders; New Trichoptera from Japan; Descriptions of Some New Mites, by N. Banks; Illustrations of an Undetermined Coleopterous Larva; The Spread of *Sphæridium scarabæoides*, by H. S. Barber; Kirby's Catalogues of Orthoptera; The Species of the Genus Chimarocephala and Descriptions of Two New Species of Californian Orthoptera, by A. N. Caudell; Notes on *Eulecanium folsomi*, by T. D. A. Cockerell; The Linnæan Genera of Diptera, by D. W. Coquillett; Larva of *Castnia licus;* A Few Notes on the Strecker Collection, by H. G. Dyar; *Catogenus rufus*, a Coleopterous Parasite, by W. F. Fiske; Notes on Some Mexican Scolytidæ, With Descriptions of Some New Species; Notes on Scolytid Larvæ and Their Mouth Parts, by A. D. Hopkins; A New Species of Donacia, by F. Knab; Some Notes on the Provancher Megachilidæ, by E. S. G. Titus; Description of a New Species of Desmocerus With a Synoptic Table of the Genus, by J. L. Webb; and A New Enemy of Timothy, by F. M. Webster.

The enemy of timothy reported from various States from New York to North Dakota appears to be a species of Isosoma. The larva works in the joints of timothy in much the same manner as does *I. grande*. A number of parasites were raised from the insect. The pest causes a shortening of the stem and shrinkage of the seed crop, and is, therefore, considered a serious enemy of timothy.

Thirty-sixth annual report of the Entomological Society of Ontario (*Ann. Rpt. Ent. Soc. Ontario, 36 (1905), pp. 143, figs. 74*).—This report contains an account of the proceedings of the forty-second annual meeting of the society, held at Guelph, Ontario, October 18 and 19, 1905.

During the different meetings of the society various papers on economic entomology were read, some of which are mentioned in the following notes: A number of reports were presented on the status of insect pests in different districts. In this report it appeared that the woolly aphis, zebra caterpillar, cottony maple scale, wire worms, and codling moth were unusually abundant. The tussock moths were discussed by T. W. Fyles and H. H. Lyman. These moths do an unusual amount of damage to ornamental and shade trees, causing considerable interest to be developed in methods of extermination. Notes were presented on the entomological conditions in North Carolina, by F. Sherman, jr.

W. Lochhead read a paper on experiments against the San José scale in 1905. It is stated that in Ontario the lime-sulphur wash has been successfully used, made according to the formula 20-15-40. Various other combinations of these ingredients have also been used in the preparation of washes with or without boiling. Little or no difference was observed in the effectiveness of the boiled and unboiled washes. In order to prevent the great multiplication of the San José scale in the fall, it is necessary that the insecticide should adhere to the trees for long periods.

J. B. Smith reviewed briefly the work on mosquitoes in New Jersey, and reports were given of the councils of the various branches of the society.

A number of other papers were read, some of which are mentioned in the following list: Insects as nature studies, by S. B. McCready; forest insects, by T. W. Fyles; insects injurious to Ontario crops in 1905, by J. Fletcher; an entomological record for 1905, by J. Fletcher; injurious insects of the flower garden, by A. Gibson; forest entomology, by E. J. Zavitz; phlox mite, spruce saw-fly, and bumblebees that fertilize the red clover, by T. D. Jarvis; injurious insects of 1905, in Ontario, by W. Lochhead.

Tenth annual report of the State entomologist of Minnesota, 1905, F. L. Washburn (*Ann. Rpt. State Ent. Minn., 10 (1905), pp. 168, pls. 2, figs. 163*).—In this

report the author carries out the apparent intention of his predecessor, Doctor Lugger, in publishing a monograph on the diptera of Minnesota. Brief notes are given in a preliminary statement on the special features of insect outbreaks during the year. The Hessian fly and chinch bug occurred in much smaller numbers than ordinarily. Alfalfa was greatly injured by the red-legged grasshopper. Various other species of insects caused damage, particularly cottony maple scale, stalk borer, cotton boll-worm in corn, white grubs, etc.

As already indicated, the major part of the report is occupied with a monograph on the diptera of Minnesota. The author describes in considerable detail the biology and anatomy of this order of insects, and presents notes on the habits, life history, and means of combating all known injurious flies in the State, together with short accounts of other diptera not of economic importance. The families which the author discussed include among others the Tipulidæ, Culicidæ, Chironomidæ, Cecidomyidæ, Simuliidæ, Syrphidæ, Oscinidæ, Oestridæ, Sarcophagidæ, Muscidæ, Hippoboscidæ, etc.

Diptera of Minnesota: Two-winged flies affecting the farm, garden, and stock and household, F. L. Washburn (*Minnesota Sta. Bul. 93, pp. 7–168, pls. 2, figs. 163*).—The material in this bulletin has already been referred to from another source (see above).

Report on economic zoology, F. V. Theobald (*Jour. Southeast. Agr. Col. Wye, 1905, No. 14, pp. 38–158, figs. 43*).—In this report the animal and insect pests are arranged according to the plants or animals which they affect.

Among the pests of domesticated animals mention is made of serrated dog tapeworm, lungworms in sheep, liver fluke, *Rhyphus fenestralis*, etc. The last-named species is reported as injurious to bees. A large number of fruit insects are discussed, with notes on their appearance, habits, and life history. Among these may be mentioned cherry sawfly, apple-plant louse, strawberry aphis, and woolly aphis. Some of the more important garden insects discussed are *Otiorhynchus picipes* on the raspberry, Colorado potato beetle, cabbage maggot, cabbage aphis, carrot aphis, tarnished plant bug, rose scale, etc.

Forest tree insects are also discussed, with particular reference to the willow weevil, larch leaf-miner, giant-willow aphis, elder aphis, and felted beech coccus. Notes are also given on some of the insect pests of food products, horse flies and other insects injurious to man, and a number of insect pests reported from various English colonies.

Report on injurious insects and plant diseases for 1904, W. M. Schøyen (*Beretning om Skadeinsekter og Plantesygdomme i 1904. Christiania: Grondahl & Sons, 1905, pp. 26, figs. 17*).—The insects which caused injury to field and garden crops during the year under report are briefly discussed. Among the more important pests mention may be made of grain aphis, timothy fly, cabbage maggot, crane flies, red spider, *Aryresthia conjugella*, apple scab, currant sawfly, currant mite, etc.

Injurious insects, F. Corboz (*Chron. Agr. Vaud, 18 (1905), Nos. 13, pp. 307–310; 14, pp. 335–342*).—Brief economic and biological notes are given on San José scale, red spider, nematodes, and predaceous insects.

The entomological section, L. Bostock and C. B. Simpson (*Transvaal Agr. Jour., 4 (1905), No. 13, pp. 162–184, pls. 2*).—A brief report is made on a survey made with reference to the distribution and economic importance of mosquitoes and on means of destroying them. Notes are also given on two migratory locusts (*Acridium purpuriferum* and *Pachytyus sulcicollis*). Arrangements are being made for an elaborate campaign against these pests.

Entomological investigations in Central Asia, J. Sahlberg (*Öfvers. Finska Vetensk. Soc. Förhandl., 46 (1903–4), No. 1, pp. 1–38*).—The most abundant insects observed in various parts of Central Asia during visits to those countries are mentioned, with brief notes on their habits.

Insects of the garden, R. H. PETTIT (*Michigan Sta. Bul. 233, pp. 77, figs. 65*).—The author has undertaken the publication of bulletins dealing with insects which affect different classes of farm and garden crops, and this is the second bulletin of the series. The insects considered in the bulletin are grouped under the plants affected. All of the common garden crops are treated, with notes on their most important insect enemies, the life histories of these pests, and means of combating them. Directions are also given for the preparation of various insecticides. The bulletin is provided with an index.

Observations and short notes on the chief insect enemies of garden crops, I. VASILEV (*Trudui Byuro Ent.* [*St. Petersb.*], *6* (*1905*), *No. 4, pp. 55, pls. 7, figs. 17*).—The insects discussed in this report are classified according to their systematic position. Biological and economic notes are given on *Zeuzera pyrina*, gypsy moth, brown-tail moth, *Hibernia defoliaria*, codling moth, apple curculio, *Epicometis hirta*, fruit-tree bark-beetle, apple-tree aphis, woolly aphis, oyster-shell bark-louse, etc.

A monograph of insect injuries to Indian corn, II, S. A. FORBES (*Rpt. State Ent. Ill., 23* (*1905*), *pp. XXXIII + 273, pls. 8, figs. 234*).—The first part of the author's monograph of corn insects (E. S. R., 8, p. 501) treated of insects injurious to the planted seed and to the roots.

The present part contains an account of insects which attack various parts of the corn plant above ground. The author and his assistants have devoted much time and energy to the study of all insects found on corn and particularly to the elaboration of suitable remedies for these pests. In the present part of the monograph on corn insects a large number of species are discussed and are classified for convenience into the more important, less important, and unimportant species. The detailed discussion of different species is preceded by an account of the adaptation and reaction of corn to its insect visitors, general effect of insect injuries, peculiar features of injury to different parts of the plant, and similar subjects.

The insects discussed by the author are too numerous for individual mention in this abstract. They include various species of cutworms, yellow bear caterpillars, webworms, June beetles, flea beetles, oyster beetles, leaf hoppers, grasshoppers, as well as ants, flies, spanworms, snout beetles, plant bugs, plant lice, red spiders, etc. A particularly valuable part of the monograph from the standpoint of the practical farmer is a key for the identification of all species concerned and based on the kind of injury which the different insects cause. This key occupies pages 225–233 and should enable the farmer to identify at once the insect pest with which he has to deal. An elaborate bibliography of literature relating to corn insects is appended to the report (pp. 234–273).

Root maggots and how to control them, F. H. CHITTENDEN (*U. S. Dept. Agr., Bur. Ent. Circ. 63, 2. ed., pp. 7, figs. 5*).—The seed-corn maggot (*Pegomyia fusciceps*) attacks corn, beans, and many other vegetables. There are apparently several generations annually.

Whatever insecticide treatments are chosen they should be applied before the eggs are laid. A mixture of sand and kerosene may be placed at the base of plants for the purpose of keeping the flies from depositing their eggs. The carbolic emulsion may be used for the same purpose, made according to the formula calling for 1 lb. of soap boiled in 1 gal. of water and ½ gal. of crude carbolic acid diluted before use with 35 to 50 parts of water. Mineral fertilizers are of some value as deterrents, and good results have also been obtained from the tedious method of hand picking.

The cabbage maggot is most injurious in the northern tier of States and in Canada. It may also be controlled by the use of carbolic acid emulsion, hand picking, fall plowing, clean cultivation, the use of gas lime, carbon bisulphid, or tarred-paper cards placed about the plants. The imported onion maggot (*Pegomyia cepetorum*) attacks the bulbs of the onion, causing subsequent decay. The insect is briefly

described. The remedies already mentioned for other root maggots may be applied in controlling this species.

Injurious bugs and cicadas on cotton, T. KUHLGATZ (*Mitt. Zool. Mus. Berlin, 3* (*1905*), *No. 1, pp. 23–114, pls. 2*).—A considerable number of species of these insects are discussed from the standpoint of their distribution, biology, and systematic position in the order of insects. Particular attention is given to *Tibicen dahli*, *Tectocoris lineola cyanipes*, *Dysdercus sidæ*, *D. cingulatus*, *D. superstitiosus*, *D. cardinalis*, *D. suturellus*, *D. andreæ*, etc. The habits and life history of each species are briefly described and detailed notes are given on the distribution of the species. A bibliography of the subject is appended to the article.

The boll weevil and cotton crop of Texas, E. D. SANDERSON (*Austin: Dept. Agr., 1905, pp. 28, pls. 7*).—The author reviews previous estimates which have been made since 1894 of the amount of damage done by the boll weevil.

Statistics were collected on the cotton acreage of Texas from 1899 to 1904 and on the variations in the acreage and in the yields which may be attributed to the work of the boll weevil. In connection with this discussion maps are presented showing the distribution of the weevil. It is believed that since its introduction into Texas the boll weevil has destroyed 2,000,000 bales of cotton with an estimated value of one hundred million dollars. The weevil is seldom extremely injurious in the southern part of Texas if stubble cotton is not allowed to remain over winter. Apparently the weevil does not promise to become very dangerous in the western cotton counties.

The remedy for the boll weevil, W. NEWELL (*Crop Pest Com. La. Circ. 3, pp. 20, figs. 5*).—Maps are given showing the gradual advance of the boll weevil into Louisiana with reference to the effects of cold rainy winters upon the pest. It is believed, however, that the boll weevil will be able to winter successfully in the cotton regions of Louisiana. The cultural method is considered the only efficient remedy for controlling the boll weevil. This consists in early planting, the use of varieties which mature quickly, the application of fertilizers, thorough cultivation, and destruction of cotton plants in the fall as well as other material in which the beetles may hibernate.

The control of the codling moth and apple scab, C. L. MARLATT and W. A. ORTON (*U. S. Dept. Agr., Farmers' Bul. 247, pp. 21, figs. 9*).—The codling moth and apple scab are considered the chief insect enemy and fungus disease of the apple. They may be controlled by the application of a combined insecticide and fungicide and are, therefore, treated together in this bulletin.

Notes are given on the habits and life history of the codling moth and upon the biology of the apple-scab fungus. Directions are given for banding trees to catch codling-moth larvæ and for the preparation of Paris green and other arsenicals as well as of Bordeaux mixture. It is recommended that in controlling these two pests the first application be made just after the leaf buds have unfolded, the second just after the petals fall, and the third and fourth at intervals of about 15 days. The first application need not contain Paris green, but the other three should be made with a combination of Paris green and Bordeaux mixture.

Practical suggestions for codling moth control in the Pajaro Valley, W. H. VOLCK (*California Sta. Circ. 14, pp. 11, fig. 1*).—In the Pajaro Valley considerable difficulty has been experienced in fighting the codling moth on account of the unusual prevalence of dews, which dissolve away the insecticides sprayed upon the trees.

Paris green was found to cause considerable injury to the trees, even after it had previously been washed so as to remove the soluble arsenic. In order to prevent the action of the dew upon Paris green it was coated with heavy oils and other waterproof materials. These coatings, however, were ultimately destroyed. Lead arsenate was found to possess a high weather-resisting property and is, therefore,

suited for this work. Considerable difference was noticed in the killing power of different samples of lead arsenate and in their action upon the foliage. Thorough spraying is needed in order to cover all parts which may be attacked by the codling moth.

Since the broods seem to overlap one another without leaving any interval between them, it is considered necessary to spray at short intervals from April until October. The author suggests 9 applications during the season on April 10 and 30, May 17, June 17, July 10, August 1 and 21, September 12, and the first week of October. These applications may be expected to yield a crop of apples from 95 to 98 per cent free from codling moth, at a total cost of about 32 cts. per tree.

The gypsy moth in New Hampshire, E. D. SANDERSON (*New Hampshire Sta. Bul. 121, pp. 81-104, figs. 11*).—The history of this moth in Massachusetts is briefly outlined and notes are given for the purpose of comparing the life history of the gypsy moth and brown-tail moth. In 1904 an examination of the southeast coast of New Hampshire showed that the gypsy moth was present in small numbers in all of the towns from the Massachusetts line to Portsmouth. A map is given showing the present distribution of the gypsy moth in New Hampshire. The life history, habits, food plants, natural enemies, and methods of combating this pest are described.

The brown-tail moth in New Hampshire, E. D. SANDERSON (*New Hampshire Sta. Bul. 122, pp. 105-132, figs. 20*).—This moth was first recognized in Massachusetts in 1890 but did not attract attention until 1897. It has spread with great rapidity, and in 1899 was first found in New Hampshire in the town of Seabrook. At present it is distributed over all of the southeastern part of the State. The life history, habits, and practical methods of combating this pest are described. Notes are also given on its natural enemies and on the injury caused by the nettling hairs of the caterpillar.

The gypsy moth and the brown-tail moth, W. E. BRITTON (*Connecticut State Sta. Bul. 153, pp. 11, figs. 8*).—The gypsy moth has been found at Stonington, Connecticut, and an attempt is being made to eradicate it. A brief account is presented of the habits and life history of the gypsy moth and brown-tail moth with practical methods of controlling these pests.

Some experiences with insecticides for the San José scale, C. O. HOUGHTON (*Delaware Sta. Bul. 74, pp. 16*).—A considerable variety of proprietary remedies were used as well as kerosene emulsion and lime-sulphur-salt washes. The applications were made for the most part in the spring but in ordinary instances in the fall.

Peach trees were sprayed with a mixture containing 15 lbs. each of lime, sulphur, and salt per 45 gal. of water boiled by steam for ½ hour. Various other formulas for the lime-sulphur-salt wash were tested, both for boiling by steam and for self-boiling caustic washes. Trees sprayed in the fall when examined during the next spring showed no living scales in the case of those which had been treated with the boiled wash and only a few of those treated with the unboiled wash. Both forms of the wash had largely been washed off the trees by February 13, little difference being observed in the adhesive power of the boiled and unboiled washes.

The chief advantage of using oil sprays is that these materials spread more rapidly over the trees but they have the disadvantage that it is not readily apparent whether all parts of the tree have been covered or not. The lime-sulphur washes gave satisfactory results in all cases and the author, therefore, recommends their use as well as that of kerosene emulsion.

The San José scale, W. NEWELL (*Crop Pest Com. La. Circ. 4, pp. 42, figs. 15*).—The introduction and spread of the San José scale in Louisiana is attributed to the fact that no quarantine system against fruit-tree pests has been in operation in the State until recently.

The San José scale is described in its various stages and historical notes are given on the distribution of the pest and upon its food plants. An account is also presented

of the development and life history of the San José scale and of the means by which it is distributed. Evidence was obtained in one case that the San José scale may be spread by means of wagons and farm implements. In applying artificial methods for controlling San José scale the chief reliance of the fruit grower should be placed in lime-sulphur-salt wash.

The formula for this insecticide recommended by the author calls for 21 lbs. lime, 18 lbs. sulphur, and 50 gal. water. This mixture should be boiled for 35 minutes or more. Where boiling is inconvenient the use of caustic soda may be depended upon to produce a mixture nearly as good as the boiled lime-sulphur wash. Applications should be made in Louisiana in the winter. Brief notes are given on insecticide apparatus and on summer treatment, where it appears to be necessary.

Spraying for the San José scale, J. S. Houser (*Ohio Sta. Bul. 169, pp. 139–155, pls. 6*).—A large number of formulas were used for boiled lime-sulphur-salt washes in which the amount of lime varied from 15 to 31 lbs., the amount of sulphur from 7½ to 16⅝ lbs., the amount of salt from 15 to 16 lbs. per 50 gal. of water for winter applications, while for summer use lime-sulphur washes were used in which both the lime and sulphur varied from 1 to 10 lbs. per 50 gal. of water. Spring treatment was also given, using self-boiled washes containing from 15 to 32 lbs. of lime, 8 to 16 lbs. of sulphur, and 4 to 12 lbs. of lye or caustic soda per 50 gal. of water.

Of the 13 different formulas used for boiled lime-sulphur-salt washes all of those which contain 15 lbs. or more of lime and sulphur per 50 gal. of water gave satisfactory results in all cases. Salt seems to add nothing to the persistency of the wash nor to its effectiveness, and the same was found to be true of copper sulphate and a large excess of lime. Copper sulphate added to the mixture had apparently no additional fungicidal effect. The addition of glue was of no value in making the wash adhere longer.

Con-Sol was tested in the treatment of San José scale, but appeared to be of no value. The use of kerosene limoid did not give satisfactory results. Scalecide is easily applied and appears not to be irritating to the skin. Better results were obtained from this than from any of the other proprietary insecticides.

The author prefers the use of the lime-sulphur mixture containing at least 15 lbs. per 50 gal. of water. This insecticide can not be applied to trees while they are in foliage. The prevalence of leaf curl in orchards is greatly checked by the use of lime-sulphur washes. The preferred formula is 15 to 20 lbs. lime and 15 lbs. sulphur in 50 gal. of water boiled for 45 minutes and applied in the spring or fall. The most satisfactory method of boiling is found in the use of steam.

San José scale, A. B. Cordley (*Oregon Sta. Bul. 88, pp. 15, pls. 5*).—The lime-sulphur-salt wash is considered the best spray for cleaning up trees, in addition to its power of holding the San José scale in check when applied once annually. The attention of orchardists is called to the fact that the wash can not be used as a substitute for Bordeaux mixture when the trees are in leaf, but should be applied as a winter treatment only.

Notes are given on the food plants, appearance, development, and distribution of the San José scale. The formula preferred in Oregon for the lime-sulphur-salt wash is 1-1-1-3, and it is recommended that the mixture be boiled for at least 1 hour. The natural enemies of San José scale can not be depended upon in Oregon for controlling the pest. A number of experiments were carried on with lime-sulphur-salt in various forms, some containing caustic soda and copper sulphate. The scales were not completely eradicated in any case, but since the spraying was done on badly infested trees, the effect of the lime-sulphur-salt wash was considered satisfactory.

Acariosis of grapes, H. Faes (*Chron. Agr. Vaud, 18 (1905), No. 16, pp. 379–400, pl. 1, figs. 6*).—The nature of the disease referred to under these names has often been misunderstood. The diseases are due to attacks of *Phytoptus vitis*, a mite which

inhabits the scales about the leaf buds and later causes a brown and sickly appearance in the leaf.

In combating this disease the author has had good results from the use of a mixture containing 2 per cent of soap and 1 per cent of a strong decoction of tobacco. In other experiments a 3 per cent solution of potassium permanganate and a 4 per cent solution of lysol or a mixture of soap and carbolic acid proved effective. It is recommended, however, that in a case of serious infestation the badly diseased vines be removed and destroyed and the others thoroughly treated.

Strawberry crown girdler, EDITH M. PATCH (*Maine Sta. Bul. 123, pp. 205–230, pls. 4*).—Complaints were made in a number of instances of large numbers of *Otiorhynchus ovatus* in houses, where they became a general nuisance. The insect appeared to be migrating or seeking a place for hibernation. They occurred in large numbers during the last part of June and the first part of July.

The larvæ of this insect were found feeding on the roots of *Poa serotina*, but in greatest numbers on strawberries. In one locality 200 larvæ and pupæ were dug up in 3 sq. ft. of infested strawberry bed. The beetles also feed on apples, cauliflower, red clovers, lawn grass, elm leaves, cotton-wood leaves, and various other plants. Little hope can be entertained of controlling them by the use of arsenate of lead and other arsenicals, and it is too difficult to apply the insecticides so as to destroy any large number of them. Camphor gum and sulphur were tried as repellents in keeping the beetles out of houses, but without success.

Notes are also given on a number of insects observed during the year, especially tussock moth, red-humped caterpillars, stalk borer, cherry tortrix, rose chafer, carpet beetle, wireworms, brown-tail moth, and nematode worms.

Caterpillars on oaks, C. W. WOODWORTH (*California Sta. Circ. 18, pp. 4*).—The live oaks in the vicinity of California Bay are seriously attacked by caterpillars, particularly *Phryganidia californica* and tent caterpillars belonging to the genus Malacosoma. *Phryganidia californica* occurs only in California and is the only representative of its family in America. It lays its eggs on the underside of the leaves of live oaks.

This pest may be combated by spraying with Paris green at the rate of 1 lb. per 2 gal. of water. The time for spraying is when the moths are seen in large numbers about the trees, for the reason that the eggs hatch soon afterwards. In the case of tall trees ladders will be necessary in order to apply the spray to the topmost branches. About 6 species of the genus Malacosoma, commonly known as tent caterpillars, attack the live oak, but also feed on other trees. They can best be controlled by destruction in the spring while they are still in their nests.

Dust and liquid spraying, C. P. CLOSE (*Delaware Sta. Bul. 72, pp. 23*).—The advantages of dust spraying are that the necessary apparatus is quite simple and inexpensive, the bulk of prepared material is small, and the material is more agreeable to handle than when in a wet form. The chief disadvantages are the impossibility of using the material during high wind or in the middle of the day.

Various methods are given for preparing and mixing dust sprays. The author tried a mixture containing lime, pulverized copper sulphite, Paris green, and sulphur. The best time for using dust insecticides is early in the morning of quiet days. The dust spray adheres to foliage almost as well as liquid sprays. A detailed account was given of the results obtained from the use of dust sprays, particularly in the treatment of apple trees for codling moth. The effectiveness of dust and liquid sprays for this purpose appeared to be nearly equal, the variation in the number of wormy apples being too small to indicate any decided advantage in favor of either method.

The author recommends the use of a liquid spraying outfit on level land where water is readily available. If, however, water is scarce and the ground on which the orchard is planted very uneven it may be a simpler and less expensive matter to spray by means of the dust method.

The K.-L. emulsions and spraying, C. P. CLOSE (*Delaware Sta. Bul. 73, pp. 20*).—The term "mixtures" for these insecticides is considered inappropriate and is abandoned in favor of "emulsions." K.-L. emulsions were used quite extensively during the past season with varying results, from success to a complete failure.

The author examined into the cause of these failures and believes that they were due largely to an incomplete preparation of the insecticide and careless spraying. It is recommended that the mixture should in all cases be made by violent churning and splashing by means of a hoe or dasher. The mixture can not be made in large lots by pumping or stirring. When not properly prepared, K.-L. emulsions are ineffective and to some extent dangerous. In some cases the grade of limoid used was not quite up to the standard. It is claimed that trees well sprayed during the previous fall remain quite free from San José scale during June and July, after which the insect begins to multiply. Two applications yearly are recommended for the K.-L. emulsions, viz, in October or November, and again in late spring. In order to increase the effectiveness of K.-L. emulsions tests were made of the combination of various substances.

A good combination was found by using sulphid of lime with the K.-L. emulsions. This gives a lime-sulphur combination with the addition of kerosene. The author reports good results from the use of K.-L. emulsions in strengths varying from 12½ to 30 per cent on peach, cherry, pear, and apple trees. Directions are also given for the combination of Bordeaux mixture with K.-L. emulsions, and also for the addition of Paris green to this mixture. It was found that K.-L. emulsion was a safe and effective insecticide for dipping nursery stock. For use in the spring the author recommends a 30 per cent strength on peach trees and 35 per cent solution on other trees.

Insects and insecticides (*Sacramento: State Hort. Com., 1905, pp. 23, figs. 22*).—The importance of careful and intelligent spraying is urged upon fruit growers. Some of the more important fruit pests are described and recommendations made regarding the best remedies for combating these insects. The more important pests mentioned in this pamphlet include San José scale, woolly aphis, prune aphis, black peach aphis, hop louse, canker worms, tussock moth, grasshoppers, peach-tree borer, peach moth, codling moth, etc.

Annual report of the royal sericultural station, Padua (*Ann. R. Staz. Bacol. Padova, 33 (1906), pp. 119*).—The work of the station, during the year 1905, is reviewed by the director, E. Verson (pp. 5-11).

In addition to a number of routine and practical matters the station studied the regeneration of the appendages of the silkworm larvæ, variations in the coloration of cocoons in Lepidoptera, disinfection with corrosive sublimate and other antiseptics in the case of flaccidity of silkworms, external markings indicating sex in silkworms, physiological coloration of cocoons, and other subjects. A study of the weight of silkworm cocoons as related to sex was carried on by E. Verson (pp. 19-25). This problem has been studied for a number of years at the sericultural station, and the conclusion is reached that the results thus far obtained indicate the impossibility of depending upon any external marks in silkworm cocoons for determining the sex.

E. Quajat reports on the prolonged estivation of silkworm eggs (pp. 26-65). These experiments were carried on with a number of races of silkworms, and in respect to the influence of heat the different races react quite differently. The green Japanese race was found to be less resistant than the yellow Japanese race or various hybrid races or the native yellow race. On the whole, it is concluded that a temperature of 15 to 17° C. is most suitable for the preservation of silkworm eggs in the summer. The same author presents an account of artificial parthenogenesis in silkworm eggs (pp. 77-92). In these experiments the author studied the influence of oxygen, high temperature, sulphuric acid, hydrochloric acid, carbonic acid, and electricity upon

silkworm eggs. E. Verson presents the results of a conference on a disease known as calcification of silkworms (pp. 66–76).

Notes are also given by E. Bisson on the influence of external conditions upon the physical properties of silk cocoons (pp. 93–101). As usual in the reports of the sericultural station, a bibliography is presented of literature relating to sericulture published during the year of the report.

FOODS—HUMAN NUTRITION.

The history of bread from prehistoric to modern times, J. Ashton (*London: The Religious Tract Society, 1904, pp. 185, pl. 1, figs. 30*).—It has been the purpose of the author to trace the history of bread making from prehistoric times to the present. Some of the subjects discussed are prehistoric bread, cereal grains in Egypt and Assyria, bread in Palestine and classic lands, eastern lands, Europe, and America, early English bread, milling, and bread making.

The varieties of bread (*Pure Products, 2 (1906), No. 1, pp. 13–20*).—A summary of data on the characteristics of graham bread, aerated bread, and other varieties.

Comparative values of different grades of wheat of crops of 1903 and 1904, R. Harcourt (*Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 66–73*).—The analytical data reported, in the author's opinion, indicate "that the milling, chemical, and baking tests fail to bring out any very wide difference in the products of the individual lots of wheat studied. In yield of flour and in color of the bread the products of the lower grades are inferior, but in strength, as shown by the chemical analysis, and in yield of bread there appears to be little or no difference."

Estimating the fineness of flour, N. Wender (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 12, pp. 747–756*).—A summary of data regarding various methods of judging of the fineness and quality of flour led to the conclusion that no very satisfactory means of judging such factors are available.

The author reports a number of experiments in which wheat flour and rye flour of different degrees of fineness were treated with hydrogen peroxid. The amount of oxygen liberated in a given time increased with the degree of fineness. The determination of this factor, which he calls the oxygen value, is of great promise, though the method is not perfected.

The facing of rice, C. H. Cribb and P. A. E. Richards (*Analyst, 31 (1906), No. 359, pp. 40–45*).—The examination of a large number of samples of rice showed that the amount of ash in the polished samples, ranging from 0.52 to 2.22 per cent, was much greater than in the dull samples where it ranged from 0.29 to 0.57 per cent. The extra ash, it was found, could be removed by agitating the rice with water 2 or 3 times and apparently consisted of magnesia and silica. Talc, French chalk, or some similar substance was probably used in polishing rice and was responsible for its added mineral matter, though the authors point out that the exact method of polishing is a trade secret.

"The proportion of foreign matter present in some of the samples is quite sufficient to constitute a fraud, inappreciable, perhaps, by the individual purchaser, but ample to give to one unscrupulous vendor an unfair advantage over his more honest rivals. . . . As the alleged adulterant is more expensive than the rice itself, there could be no possible temptation to the manufacturer to adopt the process for the purpose of fraud, and in addition to this, it might also be urged that the foreign matter generally is, and always might be, largely removed during cooking. We understand this is the custom of native cooks in India, by whom the rice is always soaked and washed before use. Whatever may be the opinion in regard to the legal aspect of the question, it is somewhat startling to reflect that an article of diet of such common and widespread use, hitherto accepted as one of the purest forms of vegetable food, should so frequently contain a substance of a foreign nature."

Bananine (*Colonizer, 11 (1906), No. 121, p. 8, figs. 2*).—Data are given regarding the composition and characteristics of bananine, a flour prepared chiefly from Jamaica bananas. It is stated that palatable bread can be made from this product.

Floating manna grass (Glyceria fluitans), an almost forgotten native cereal, C. HARTWICH and G. HÅKANSON (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 8, pp. 473–478, fig. 1*).—The floating manna-grass seed, according to the authors' analysis, contains 13.54 per cent water, 9.69 per cent protein, 0.43 per cent fat, 75.06 per cent starch and sugar, 0.21 per cent crude fiber, and 0.61 per cent ash. This grain is sometimes used as food. [It is also found in the United States.]

The losses in weight when fish flesh is dried, F. PETERS (*Arch. Hyg., 54 (1905), No. 2, pp. 101–106*).—The losses which fish sustain when dried were studied, and found to vary considerably with different species and with different specimens of the same species, the average loss being 30.18 per cent, or, according to the author, less than the average values for different kinds of meat. The loss is chiefly due to water, though in some cases the dried material contained a little less ether extract than the fresh. The food value of dried fish as compared with dried meat is briefly discussed from the standpoint of ease of utilization.

The composition of unripe and canned peas, H. FRERICHS and G. RODENBERG (*Arch. Pharm., 243 (1905), No. 9, pp. 675–683*).—A number of samples of young and older green peas and canned green peas were analyzed, special attention being paid to the kind and amount of sugar present.

The proximate constituents of green peas did not vary much with the degree of ripeness. On the other hand, the age, irrespective of size, had a marked effect on the sugar content, the young peas containing from 16.05 to 28.37 per cent sugar, peas of medium size 10.33 to 17.60 per cent, and ripe peas 4.97 to 13.61 per cent. Similar differences were noted in the canned peas. As regards the character of the sugar present in young peas, tests showed that maltose, mannit, and inosit were absent and that the sugar present was cane sugar. The presence of added sugar in canned peas is spoken of.

Jams, marmalades, and jellies, A. MCGILL (*Lab. Inland Rev. Dept. [Canada] Bul. 104, pp. 19*).—Of 98 samples of jams, marmalades, and jellies collected in the Dominion of Canada, 66 per cent were found to contain glucose, 15 per cent preservatives, and 30 per cent dyes.

Olive oil, A. MCGILL (*Lab. Inland Rev. Dept. [Canada] Bul. 111, pp. 12*).—Of 108 samples of salad oils collected in the Dominion of Canada 66 were genuine olive oil, 2 were doubtful, 24 were cotton-seed oil sold as salad oil, and 16 were cotton-seed oil sold as olive oil.

"Certain highly refined grades of cotton-seed oil may be regarded as valuable foods, and as these take the place of olive oil in the making of salads it is perhaps not unnatural that they should be termed salad oils. It is, however, much to be regretted that such brands of cotton-seed oil are not sold under some characteristic name, such as cotton-seed salad oil, thus making their fraudulent sale impossible. When a salad oil is asked for the sale of cotton-seed oil properly refined can not be called adulteration, but when the article offered is plainly named as olive oil the substitution of cotton-seed oil in whole or in part is, of course, a case of adulteration."

A honey substitute, G. REISS (*Arb. K. Gsndhtsamt., 22 (1905), pp. 666–668*).—A honey substitute for which the name "Fruktin" was proposed was found to consist of cane sugar, with a small amount of tartaric acid and caramel.

New honey surrogates, A. BEYTHIEN (*Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 1–2, pp. 14–16*).—The composition of commercial honey surrogates is reported. One product consisted wholly or largely of cane sugar, and the other of cane sugar and starch sirup.

Highly colored confectionery, T. MACFARLANE (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 112, pp. 11*).—An examination was made of 111 samples of highly colored confectionery. One sample was found to contain arsenic, but the quantity was so very minute that it would be, in the author's opinion, completely harmless. None of the other samples contained lead or arsenic. The report furnishes data regarding the character of the coloring matters found and the cost of the confectionery.

Concerning spices. I, Pepper and cinnamon, H. LÜHRIG and R. THAMM (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11* (*1906*), *No. 3, pp. 129–134*).—Analyses of a large number of samples of pepper showed that with one exception the sand-free ash ranged from 4.67 to 5.28 per cent, and the alkali value of total ash from 9.7 to 11.3 per cent. The importance of these and other similar factors in determining the purity of pepper is discussed. In the case of cinnamon, the analytical data reported indicate that such factors are not equally satisfactory for judging of quality.

Ground pepper, A. McGILL (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 106, pp. 20*).—Of 290 samples of ground pepper examined 116 were found to be adulterated and 3 were doubtful. "The very high ash found for some samples of black pepper leads to the inference that the outer husks, separated in the preparation of the berries for grinding as white pepper, have been added to black pepper. It is difficult otherwise to account for such high ash as 10 to 15 per cent found in at least 12 samples analyzed."

Peppers, T. MACFARLANE (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 103, pp. 9*).—The data reported show that 47.7 per cent of the 86 samples of black and white pepper examined were adulterated and 40.7 per cent were genuine, while the remainder were doubtful.

Tincture of ginger, A. McGILL (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 110, pp. 14*).—In this investigation 108 samples of alcoholic preparations of ginger were examined, 70 per cent of these being so-called extract of ginger and the remainder ginger tinctures and essences. Of the samples of tincture of ginger 74.2 per cent were considered genuine.

Vinegar, A. McGILL (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 108, pp. 15*).—The mean acetic acid content of 242 samples of vinegar examined was 5.66 per cent, though the range was considerable. In the author's opinion, samples containing less than 3 per cent of acetic acid were objectionable as being too weak, while those that contained more than 8 per cent were fortified by the addition of acetic acid and therefore factitious. The question of possible metallic impurities was also studied and it was found that 12 of the samples examined contained traces of lead and 2 traces of zinc.

Cream of tartar, A. McGILL (*Lab. Inland Rev. Dept.* [*Canada*] *Bul. 109, pp. 14*).—The author reports data regarding the examination of 180 samples of cream of tartar. Of these 73 per cent were genuine, 19 per cent adulterated, and 8 per cent doubtful.

German food book (*Deutsches Nahrungsmittelbuch. Heidelberg: Carl Winter, 1905, pp. VIII+245, figs. 6*).—This volume, which was prepared by the German Association of Food Manufacturers and Dealers, contains explanatory definitions of the principal foods, condiments, and commercial products; a summary of German legislation of interest to manufacturers; and related data.

The value of fruit and vegetables in the diet, M. RUBNER (*Hyg. Rundschau, 15* (*1905*), *Nos. 16, pp. 817–828; 17, pp. 865–872*).—The author has summarized and discussed data regarding the composition and food value of fruits and vegetables, the importance of their ash constituents, the hygiene of handling and storing these food products, and related questions.

Distinctive features of animal and vegetable dietaries, L. B. MENDEL (*Amer. Med., 10* (*1905*), *No. 20, pp. 818–820*).—The comparative value of animal and vegetable diets is discussed on the basis of recent investigations in physiology and physiological chemistry.

The author points out that some of the more recent and popular vegetarian foods imitate meat foods quite closely in flavor and that this is a matter of importance from a physiological standpoint. "An instinctive craving for the normal stimulants to digestion is thereby satisfied. A bland diet is distinctly unphysiologic, and the explanation of this fact is no longer to be sought by empiric methods alone."

Many persons believe that a diet of vegetable foods with milk and eggs is especially valuable since it furnishes a minimum of purin bodies. The author considers it probable that the success attending the adoption of purin-free dietaries is attributable as much to the abstemiousness which they induce as to the absence of the so-called uric acid precursors and is of the opinion that no one would maintain that the actual nutrients of cereals, fruits, or nuts are of themselves more nutritious than those derived from animal sources.

"Vegetarianism undoubtedly has its place in ameliorating various functional disorders, without laying claim to any mysterious properties. . . . In the field of dietetic therapy, radical changes of diet frequently supply essential factors, or eliminate deleterious ones in most welcome and unsuspected ways. But the exclusive system has no adequate justification."

Climate and health in hot countries, G. M. GILES (*London: John Bale, Sons & Danielsson, Ltd., 1904, pt. 1, pp. XX+184, pls. 2, figs. 16*).—This is a popular treatise on personal hygiene in the hotter parts of the globe and related questions, useful information gained by personal experience being summarized. There are chapters on domestic architecture, clothing, water, food, insect pests as a means of transmitting disease, etc.

Great stress is laid upon the importance of a clean milk supply and the necessity of caring for cattle and handling milk in a sanitary way.

Boiling water for drinking, for culinary, and for toilet purposes is recommended as the most satisfactory way of preventing the transmission of disease by this channel. Thorough cooking of foods for purposes of sterilization is recommended, and the need of protection from flies and other insects and from dust is insisted upon.

The second part of the volume, which is devoted to tropical climatology, etc., is reviewed under another heading (p. 939).

The provisioning of the modern army in the field, H. G. SHARPE (*Kansas City, Mo.: Franklin Hudson Pub. Co., 1905, pp. 116, pls. 12*).—The organization and operation of the commissary department, transportation problems with reference to food supplies, utilization of local resources, and other questions concerning the provisioning of armies in active service are discussed, the author's object being to give an idea of the difficulties which attend the provisioning of troops in the field with the hope that measures may be devised for improvements. The volume contains a bibliography.

Field cookery, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 10 (1905), No. 50, pp. 755–758, figs. 6*).—Different devices for use in field cookery are described with special reference to their use in providing food for large bodies of laborers, etc. Some data are also summarized regarding the efficiency of different kinds of fuel.

Self-cooker, G. H. MURPHY (*Mo. Consular and Trade Rpts. [U. S.], 1905, No. 302, pp. 242, 243*).—Data are quoted regarding the value of a self-cooker and the efforts which are being made in Germany to introduce such devices into workingmen's homes.

The digestibility of evaporated cream, T. MOJONNIER (*Med. News [Phila.], 87 (1905), pp. 877–884*).—When treated with artificial gastric juice the author found that protein of evaporated cream digested a little more rapidly than that of raw, pasteurized, or boiled milk. From digestion experiments with a child and a man it appeared that the child digested evaporated cream a little more thoroughly than the adult. Evaporated cream, the author concludes, like other forms of pure milk, is an

economical article of diet since its nutrients are practically all available for the needs of the body.

The influence of diet on growth and nutrition, C. Watson and A. Hunter (*Jour. Physiol., 33* (*1905*), *Nos. 4-5, Proc. Physiol. Soc., 1905, p. XIII; 34* (*1905*), *1-2, pp. 111-132, figs. 2, dgms. 16*).—The authors studied the influence of different diets on the growth and general nutrition of animals (rats). The diets comprised bread and skim milk, porridge made with skim milk, rice, raw horse meat, and raw beef.

In the author's opinion, a meat diet had an injurious effect, as was evident from the mortality in early life of the second generation of meat-fed subjects. "In the case of animals deprived of their ovaries the minimum amount of proteid requirement is less than in normal females. The permanent stunting of growth [was] associated with the use of a faulty diet in the growing period." Unfavorable results were obtained on the porridge diet with young subjects. Attention is directed to the similarity in chemical composition of the porridge and bread and milk diets.

Experiments on the protein and mineral metabolism in man, G. von Wendt (*Skand. Arch. Physiol., 17* (*1905*), *No. 3-5, pp. 211-289, figs. 4*).—In the experiments reported the metabolism of protein, sulphur, phosphorus, calcium, magnesium, potassium, sodium, chlorin, and iron was studied, and the influence of different sorts of food on the excretion of mineral constituents and other topics are discussed.

Some of the author's conclusions follow: Sulphur formed by the cleavage of protein is excreted more rapidly than nitrogen and therefore offers a better means of judging of the progress of protein cleavage. The calculated amount of phosphorus required daily per kilogram of body weight is about 0.01 gm., the calcium 0.008 gm., and the amount of magnesium 0.001 gm.

Replacing protein by gelatin in metabolism experiments, M. Kauffmann (*Arch. Physiol.* [*Pflüger*], *109* (*1905*), *No. 9-10, pp. 440-465*).—According to experiments made with a dog and with man, gelatin may replace protein in the diet if it is supplemented by suitable materials for building up the protein molecule. In a test of this character in which the author was the subject 93 per cent of the protein nitrogen was replaced by gelatin nitrogen, 4 per cent by tyrosin nitrogen, 2 per cent by cystin nitrogen, and 1 per cent by tryptophan nitrogen.

Experiments on the effect of tea upon stomach secretion, T. Sasaki (*Berlin. Klin. Wchnschr., 42* (*1905*), *No. 49, p. 1517; abs. in Zentbl. Physiol., 19* (*1905*), *No. 24, p. 919*).—It appeared from the experiments that tea hindered slightly the quantity of gastric juice and its acidity.

A new nitrogenous constituent of normal human urine, P. Hári (*Ztschr. Physiol. Chem., 46* (*1905*), *No. 1-2, pp. 1-8*).—The author has isolated a constituent (or rather its compounds) of urine, which he believes is different from urobilin, oxyprotein acid, and other known constituents.

Recent advances in physiology and biochemistry, edited by L. Hill (*New York: Longmans, Green, & Co.; London: Edward Arnold, 1906, pp. XII+740, figs. 33*).—This volume contains a number of papers by B. Moore, J. J. R. Macleod, L. Hill, M. S. Pembrey, and A. P. Beddard, summarizing the recent advance which has been made along a number of lines of research.

Such subjects are included as uric acid metabolism, hemolysins and immunity, the metabolism of fat and treatment of obesity, the influence of temperature and relative dryness of the atmosphere, of work, diet, baths, clothing, etc., on metabolism, the action of the digestive ferments, catalysts and chemical excitants, the colloidal structure of living matter and the influence of electrolytes in solution, the formation and absorption of lymph, the urinary excretion, etc. Each article contains a bibliography.

As the preface states, this book is designed "to set before the student of medicine the progress made in those branches of physiological study which have an immediate bearing on pathology and therapeutics, and to thereby give him an insight into the methods of research, and a training in the processes of deduction, which can not be gained from the bare and unstimulating outline of the text-book."

ANIMAL PRODUCTION.

The destruction of foods and feeding stuffs by micro-organisms. VI, The decomposition of vegetable feeding stuffs when air is excluded, J. König, A. Spieckermann, and H. Kuttenkeuler (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11* (*1906*), *No. 4, pp. 177-205*).—Bacteriological and chemical studies are reported in continuation of earlier work (E. S. R., 17, p. 687), as well as experiments in which goats and sheep were fed spoiled cotton-seed meal and cocoanut meal for a long time. In general, the health of the animals was not injured.

The spontaneous combustion of hay, F. W. J. Boekhout and J. J. O. de Vries (*Centbl. Bakt.* [*etc.*], *2. Abt., 15* (*1905*), *No. 17-18, pp. 568-573*).—Continuing earlier work (E. S. R., 16, p. 1004), from which the conclusion was drawn that the spontaneous combustion of hay was due to chemical processes and not to micro-organisms, the authors have studied the products formed when hay becomes heated with a view to learning which constitutents are directly concerned in the process. According to the results so far obtained it is nitrogen-free extract which undergoes decomposition, and the bodies which are responsible for this cleavage, that is, for the spontaneous combustion of hay, are neither soluble in water nor in 2 per cent sodium hydroxid solution.

Micro-photographs of the chaff of Gramineæ of importance in the examination of foods and feeding stuffs, H. Neubauer (*Landw. Jahrb., 34* (*1905*), *No. 6, pp. 973-984, pls. 5*).—The material described and illustrated is arranged with a view to facilitating inspection work.

Phosphate of lime in the feeding of farm animals, L. Grandeau (*Ann. Sci. Agron., 2. ser., 10* (*1905*), *II, No. 1, pp. 1-19*).—It is pointed out that phosphate of lime is an important addition to the ration of farm animals whenever the amount naturally supplied by feeding stuffs is insufficient, and investigations which have to do with this subject are summarized.

The energy value of red clover hay and corn meal, H. P. Armsby and J. A. Fries (*Landw. Jahrb., 34* (*1905*), *No. 6, pp. 861-923, pls. 2*).—An account of investigations noted from another publication (E. S. R., 17, p. 579).

Concerning the amount of saliva secreted and its relation to the physical characteristics of the feed, A. Scheunert and G. Illing (*Zentbl. Physiol., 19* (*1905*), *No. 23, pp. 853-856*).—The experiments reported were performed with 2 healthy horses. The esophagus had been operated upon in such a way that the food could be collected after it was swallowed.

It was found that 500 gm. of oats required for chewing and swallowing 960 gm. of saliva, and a like quantity of hay 2,500 gm.; a mixture of 300 gm. of oats and 100 gm. of chopped straw, 1,080 gm. of saliva; and 300 gm. of maize, 570 gm. of saliva. In earlier investigations it was found that 485 gm. of fresh grass required 335 gm. for insalivation. The recorded data show, in the authors' opinion, that physical characteristics (dryness and roughness) determine the amount of saliva secreted when food is chewed and swallowed, and that chemical composition does not influence it.

The adaptation of the salivary secretion to diet, C. H. Neilson and O. P. Terry (*Amer. Jour. Physiol., 15* (*1906*), *No. 4, pp. 406-411*).—In experiments with dogs it was found that the salivary glands and their secretions adapted themselves to the diet, sugar being found much more quickly in the case of bread-fed dogs than those fed meat.

"The saliva is more active than the gland extract, and the latter responds to the diet like the glands themselves. It is a well-known fact that extracts of glands in general are less active than the secretions. It may be that the gland contains a proferment. This may account for the latent period being longer in the gland extract than in the saliva itself, as the proferment must first be changed into the active

ferment. It is conceivable that this adaptation occurs in the human being if a proper diet is given—namely, that on a starchy diet the amylolytic power of the saliva is increased. This is being investigated, and the result will be reported later."

Studies on the digestion of herbivorous animals, P. BERGMAN (*Skand. Arch. Physiol., 18 (1906), No. 1-2, pp. 119-162*).—The literature of the subject is reviewed at length and experiments with intestinal ferments of Herbivora are reported, especially those of the cecum, as well as studies of the effects of ferments occurring in plants on natural and artificial digestion.

Rabbits were used for the natural digestion experiments. In some of the tests the hay or straw used was cooked to destroy the enzyms normally present. Such treatment diminished the digestibility of protein and nitrogen-free extract, but increased the digestibility of pentosans and crude fiber.

According to the author, proteolytic and sugar-forming enzyms are present in uncooked hay and straw, which are very powerful. The diminished digestibility of protein of heated hay was attributed in part to the effect of heat on the protein and in part to the destruction of the proteolytic enzyms. The diminished digestibility of the nitrogen-free extract was attributed to the destruction of cytases. That amylolytic enzyms were not responsible is shown by the fact that in all the experiments starch was thoroughly digested.

The digestive processes in horses when maize is fed, A. SCHEUNERT and W. GRIMMER (*Ztschr. Physiol. Chem., 47 (1906), No. 1, pp. 88-125*).—At the end of a fasting period horses were fed a ration of 1,500 gm. maize and killed at periods varying from 30 minutes to 9 hours after the food was taken, the work as a whole being similar to earlier investigations by H. Goldschmidt [a], in which horses were fed oats.

From a study of the stomach and intestines and their contents deductions were drawn regarding the digestibility of maize, some of which follow: The movement of food through the digestive tract varied greatly with different animals. The stomach contents, aside from the portion near the fundus membrane, had at first an alkaline reaction but soon became acid. Whatever the reaction, lactic acid fermentation could be detected in the intestines, as well as gaseous fermentations, some of the gases produced being inflammable.

Considering the digestion and resorption of carbohydrates in the stomach and intestines as a whole it appeared that in the first 2 hours 20 to 30 per cent of the amount consumed was digested and about 20 per cent resorbed. In the eighth to the ninth hour about 50 per cent was digested and r sorbed. The digestion of maize protein in the stomach is very rapid and at first proceeds much like that of oat protein, though later it surpasses it. After 5 or 6 hours about 50 per cent of the protein of both oats and corn in the stomach was digested. The rate of digestion in the stomach and intestines and other questions are considered.

The rational feeding of farm animals by syndicates, KOHLER (*L'amélioration rationnelle du bétail, par les syndicats d'elevage. Paris: Librairie Agricole de la Maison Rustique, 1906, pp. 146; noted in Bul. Soc. Nat. Agr. France, 66 (1906), No. 1, p. 119*).—A general treatise on cattle feeding on a large scale.

Production and feeding of cattle, horses, asses, and mules, P. DIFFLOTH (*Production et alimentation du bétail, cheval, ane, mulet. Paris: J. B. Baillière & Sons, 1904, pp. XVI + 504, figs. 140*).—This volume, which is one of the series entitled Encyclopédie Agricole, is a general treatise on the breeding, feeding, care, and management of cattle, horses, asses, and mules.

Sheep, goats, and pigs, P. DIFFLOTH (*Mouton, chèvre, porc. Paris: J. B. Baillière & Sons, 1905, pp. VIII + 418, figs. 90*).—The general characteristics of sheep, goats, and pigs, breeds, feeding, care, management, and related questions are taken up in this volume, which is one of the series entitled Encyclopédie Agricole.

[a] Ztschr. Physiol. Chem., 10 (1886), p. 361; 11 (1887), p. 286.

Cattle feeding experiment, W. Bruce (*Edinb. and East of Scot. Col. Agr. Bul. 8, pp. 35-47*).—Using 3 lots of 8 2-year-old Irish cattle, the relative merits of decorticated, Egyptian, and Bombay cotton-seed cake were studied. In the 20 weeks covered by the test the average daily gain per head on the decorticated cotton-seed cake ration was 1.93 lbs., and on both the Egyptian and the Bombay cake rations 2.07 lbs.

According to the author, "Bombay cotton-cake has turned out more effective per unit than Egyptian cotton-cake. . . . Bombay cotton-cake has been found a cheap, safe, and suitable food for starting the winter feeding of 2-year-old bullocks which are receiving a liberal ration of turnips. About 6 lbs. per head per day, however, is probably about the maximum quantity it is advisable to use. When the feed of concentrated food rises above this quantity the Bombay cotton-cake should be supplemented by a food containing more oil, e. g., linseed cake."

Feeding broken or crushed bones to cattle, D. Hutcheon (*Agr. Jour. Cape Good Hope, 28 (1906), No. 2, pp. 210-212*).—It is a common practice with many farmers in South Africa to give their cattle broken bones (which are readily eaten) to supply the body with phosphates.

Experiments were undertaken to learn the comparative digestibility of small pieces of bone and bone meal. Two lbs. of roughly crushed bone 0.17 to 0.5 in. in size were introduced into the stomach of a fasting ox through an opening in the rumen. These bones were excreted apparently unchanged by the action of the digestive juices. When crushed dried bone about the size of coarse oatmeal was fed to a steer at the rate of a pound a day for 7 days it was apparently completely digested, none of the bone being found in the excreta. The bone and the oats which were fed at the same time were dyed with methylene blue. Many of the oats were recovered in the feces still colored.

Measure of the mechanical work performed by Limousin cattle, Ringelmann (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 16, pp. 628-631*).—According to the measurements reported, a pair of Limousin cattle 4½ years old, weighing 1,380 kg. with the yolk, furnished mechanical work equivalent to 190 kilogram meters of available work per second, from which the conclusion is drawn that this race of cattle makes excellent draft animals.

Tests of the strength of oxen, M. Ringelmann (*Bul. Soc. Nat. Agr. France, 65 (1905), No. 8; abs. in Rev. Gén. Agron., 15 (1906), No. 1, pp. 29-32*).—The method rests on the assumption that the "mean sustained effort which can be furnished in steady work" is a constant proportion of the maximum effort that the animal can put forth. A similar definite relation is assumed between the maximum speed without a load and the mean sustained speed when doing work. These relations have been experimentally shown to be approximately 25 per cent and 30 per cent, respectively—that is to say, the actual rate of work is represented by $.25 \times .30 = .075$ of the product of maximum pull and maximum speed. When both of these elements are considered it may happen that owing to favorable build an animal showing rather light draft exhibits greater power than a heavier and slower animal.

Twenty-nine yoke of oxen were tested, the strongest pair developing a mean rate of work of 190 kilogram meters per second, or 2.5 horsepower. It is found necessary to have the oxen driven by a familiar hand, as they do not do their best for strangers. A special harness was used which reduces the maximum pressure on the animal, as otherwise the effort put forth would be limited at the point where the pressure becomes painful.

Theoretical and practical calf feeding, M. Rasquin (*L'alimentation théorique et pratique du veau. Renaix, Belgium: J. Leherte-Courtin, 1905, pp. 93, figs. 2*).—The general functions of nutrition are discussed and information summarized on the value of a large number of materials as supplements to skim milk in calf feeding, including among others meat meal, potato starch, flaxseed (alone and with corn meal and with

different kinds of starch), bread, ground grain, eggs, meat powder, calf feeds, sugar, dried blood, and hay tea.

Much of the work summarized was carried on under the author's supervision. The different feeding stuffs are not compared, but the investigations as a whole warrant the deduction that milk fat may be profitably replaced by other feeding stuffs in calf feeding. One of the topics discussed at some length is the importance of phosphate of lime (ground bone) in the rations of young animals.

Steam-cooked milk for calves, Bugge (*Ztschr. Fleisch u. Milchhyg., 16 (1906), No. 7, pp. 228–230*).—In connection with a consideration of the feeding of sterilized milk to calves to prevent the spread of tuberculosis, tests were reported of the amount of water which the passage of the steam through it added to the milk in a given time. It required 50 minutes to raise the temperature of 150 liters of milk from 10 to 85° C. The increase in volume was in round numbers 23 liters.

Pig feeding experiments with dried sugar-beet chips and dried potato pulp, Klein (*Milchw. Zentbl., 1 (1905), No. 12, pp. 529–537*).—The feeding experiments reported showed, in the author's opinion, that as good results were obtained when dried potato pulp was added to a barley and skim milk ration as when barley and skim milk were fed alone. Less satisfactory results were obtained with the dried sugar-beet chips. An examination of the fat of the pigs showed no marked differences which could be attributed to the different feeding stuffs tested.

Twenty years' experiments on the feeding of work horses, L. Grandeau and A. Alekan (*Ann. Sci. Agron., 2. ser., 10 (1905), II, Nos. 1, pp. 138–160; 2, pp. 161–225, figs. 4*).—The investigations which the authors have carried on for 20 years with work horses are summarized and a number of deductions drawn regarding the variation in price of feeding stuffs, digestibility, and food value of different rations, the economy of substituting various feeding stuffs and mixtures for oats, and related questions. The investigations referred to have been noted (E. S. R., 16, p. 587)

Barley for horses, P. Van Biervliet (*Rev. Gén. Agron., 14 (1905), No. 10–11, pp. 458–461*).—A summary of data showing the decided value of barley for horses.

Poultry raising, C. Voitellier (*Aviculture. Paris: J. B. Baillière & Sons, 1905, pp. XII + 484, figs. 158*).—A general treatise on poultry raising in which the principal characteristics of various breeds of chickens, ducks, geese, turkeys, guinea hens, and pigeons are described, and questions of feeding, breeding, housing, and management are discussed.

Poultry houses and fixtures (*Quincy, Ill.: Rel. Poultry Jour. Pub. Co., 1906, 6. ed., pp. 95, figs. 174*).—A number of papers by different authors are including in this publication, which takes up the construction of poultry houses, sheds, fixtures, coops, yards, and similar questions.

Races of domestic poultry, E. Brown (*London: Edward Arnold, 1906, pp. XII + 234, pl. 1, figs. 89*).—In this discussion of the races of domestic poultry of different countries, it has been the author's intention to consider the qualities which bear upon profitable poultry raising rather than external characteristics. The attempt has been made to trace the origin, history, and distribution of domestic poultry and to show the evolution of breeds and their classification. Special attention is paid to judging poultry and to the relation between external characteristics and internal qualities with reference to poultry breeding.

Poultry division, D. D. Hyde (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 133–151, figs. 9*).—Statistics of the egg trade and poultry industry are given, as well as descriptions of egg cases and trap nests. The work of the poultry-breeding stations and other topics connected with the work of the poultry division are also briefly spoken of.

The year's work in poultry, D. F. Laurie (*Jour. Dept. Agr. So. Aust., 9 (1906), No. 6, pp. 391–396*).—Data are given regarding commercial poultry breeding, laying competitions, poultry societies, diseases and pests, and related questions. In the

author's opinion the last year has been a very successful one for the local poultry industry.

How frequently does the setting hen turn her eggs? H. F. Prince (*Cornell Countryman, 3 (1906), No. 6, p. 139, fig. 1*).—From observations made with a number of hens it was found that in every instance the eggs were moved every day and did not remain in the same part of the nest for more than 3 days. "The thorough manner in which the hen turns the eggs may well furnish us a clue to the most natural and proper treatment of the eggs when under the artificial conditions of the incubator."

DAIRY FARMING—DAIRYING.

Dairy investigations in the northeast of England, D. A. Gilchrist and C. B. Jones (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 63-74*).—Studies of variations in the composition of milk and their probable causes have been in progress for a number of years, some of the results of which having already been reported (E. S. R., 15, p. 906).

The experiments in 1904-5 showed that when cows were milked at 6 a. m. and 6 p. m., the morning milk contained on an average 4 per cent of fat and the evening milk 3.6 per cent, but when the cows were milked at 6 a. m. and 4 p. m., the percentages were respectively 3.6 and 4.3. The average daily yield of milk was somewhat greater when the intervals between milkings were equal. Some creaming tests are also reported.

Milk investigations at Garforth, 1905, C. Crowther (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 110-142*).—Feeding grain to cows on pasture was studied experimentally with 2 lots of 5 animals each, in periods lasting from July 18 to October 9. Commencing with a daily ration of 2 lbs. of undecorticated cottonseed cake and 2 lbs. of decorticated cake, the amount of the latter was increased to 4 lbs. and later to 6 lbs. Under the conditions of the experiment the smaller ration proved insufficient for maximum production and the most liberal feeding was far from economical.

Milk records, J. Speir (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 237-280*).—Tests were made of 815 cows belonging to 30 herds. Two milk-record societies were represented. The tests of 18 herds were made every 21 days during 1 year and of the remaining herds every 14 days for 34 weeks.

Calculated to a basis of milk containing 3 per cent of fat, the average production of cows tested for the entire year was 875 gal. The average production of 10 per cent of the best cows of these herds was 1,170 gal. of 3 per cent milk, and of 10 per cent of the poorest cows, 677 gal. Ten per cent of the best cows in the remaining herds produced, on an average in 34 weeks, 826 gal. of 3 per cent milk, and 10 per cent of the poorest cows, 526 gal. Tables are also given showing the milk production according to the age of the cows.

Influence of asparagin on milk production, T. Pfeiffer (*Abs. in Centbl. Agr. Chem., 35 (1906), No. 1, pp. 48-51*).—In experiments with goats, the substitution of asparagin for a part of the proteids in the ration produced a marked decrease in the fat content of the milk without materially lowering the yield, and was unfavorable to the growth of the animals.

Feeding dairy cows, C. D. Smith (*Michigan Sta. Bul. 234, pp. 85-109*).—This is essentially an abridged form of Bulletin 149 of the station (E. S. R., 9, p. 1081).

Is the passage of food fat into milk demonstrable by the Winternitz method of feeding iodized fat? S. Gogitidse (*Ztschr. Biol., 47 (1906), No. 4, pp. 475-486*).—This is a critical review of the literature of this subject with a bibliography. The method, as brought forth by K. Winternitz, consists in feeding the animal iodized fat and examining the milk for the presence of iodin. The author's

opinion is unfavorable to this method as a means of demonstrating the direct transformation of food fat into milk fat.

On the Baudouin reaction in human milk fat, ENGEL (*Ztschr. Angew. Chem., 19 (1906), No. 7, pp. 283-286*).—A positive Baudouin reaction was regularly obtained 1 to 1½ hours after feeding sesame oil. This period was followed by a second period, in which the reaction was negative, and this by a third period, in which a positive reaction was again obtained. When the feeding of sesame oil was continued for 7 days the reaction was positive for all three periods.

Purity of Raleigh's milk supply, F. L. STEVENS (*Raleigh, N. C.: Bd. Aldermen, May, 1905, pp. 7*).—Forty samples of milk collected in Raleigh, N. C., from February 4 to April 29 were examined, the results showing no sample containing less than 34,000 bacteria per cubic centimeter. Only 9 samples contained less than 100,000 and 17 contained more than 1,000,000. The fat content in no instance fell below 3 per cent. The relation of dirt in milk to bacterial content is illustrated by the following figures: Milk containing 5.2 mg. of dirt per liter showed the presence of 3,338,775 bacteria per cubic centimeter; milk containing 20.7 mg., 7,079,829 bacteria, and milk containing 36.8 mg., 12,897,600 bacteria.

Milk treated with hydrogen peroxid, P. ADAM (*Rec. Méd. Vét., 83 (1906), No. 6, pp. 169-173*).—The author endeavored to determine whether milk free from hydrogen peroxid was previously treated with this substance. Storch's reagent consisting of paraphenylenediamin, and Schardinger's reagent consisting of methylene blue and an aldehyde were tested for this purpose.

The following conclusions were reached: Raw fresh milk not previously treated with hydrogen peroxid is colored red by the addition of guaiac and hydrogen peroxid, and blue by paraphenylenediamin. The methylene blue is decolorized by the presence of an aldehyde. The same milk, when spoiled, no longer gives the first two reactions but still decolorizes Schardinger's reagent. Raw milk containing hydrogen peroxid gives the color reaction with guaiac alone or with paraphenylenediamin alone and does not change the color of Schardinger's reagent. Raw milk previously treated with hydrogen peroxid but no longer containing this substance gives, upon again adding hydrogen peroxid, the same reactions as pure milk with guaiac and paraphenylenediamin, but unless putrefied does not decolorize methylene blue. Boiled milk shows none of the preceding reactions.

Action of formalin and hydrogen peroxid on milk, P. BANDINI (*Riv. Ig. e Sanit. Pub. [Rome], 16 (1906), p. 23; abs. in Biochem. Centbl., 5 (1906), No. 3, p. 144*).—According to the author, formalin interferes with the action of rennet on milk, the change produced being increased by the length of time formalin acts and by the amount added. On the contrary, milk treated with hydrogen peroxid shows a normal reaction with rennet.

Neither formalin nor hydrogen peroxid exerts a marked influence on the soluble ferments in milk. Formalin, even in small quantities, interferes with the proteolytic ferments such as pepsin and pancreatin and in large quantities affects to a marked extent the chemical and physical properties of the precipitated casein. Hydrogen peroxid does not have this effect. The addition of formalin in the proportion of 1:5,000 to 1:10,000 preserved milk from 6 to 12 days. The addition of hydrogen peroxid in the proportion of 1:100 to 3:100 preserved milk from 1 to 6 days.

Methods of preserving milk, P. VIETH (*Fühling's Landw. Ztg., 55 (1906), No. 4, pp. 113-120*).—The author discusses the importance of preventing contamination as a means of improving the keeping qualities of milk and the preservation of milk by means of cold, pasteurization and sterilization, chemical preservatives, and other means.

On the preservation of milk with hydrogen peroxid, EICHHOLZ (*Milchw. Zentbl., 1 (1905), No. 11, pp. 500, 501*).—This is a criticism of the work of Baumann previously noted (E. S. R., 17, p. 74).

Preservation of milk before skimming, L. MARCAS and C. HUYGE (*Bul. Agr. [Brussels], 21 (1905), No. 6, pp. 1111-1115*).—Practical methods of straining, cooling, etc., are mentioned and their value illustrated by experimental data.

Action of the ultra-violet rays on milk, N. GERBER and A. HIRSCHI (*Rev. Gén. Lait, 5 (1906), No. 11, pp. 252, 253.; Milchw. Zentbl., 2 (1906), No. 3, pp. 119, 120*).—Attempts to sterilize milk by means of the ultra-violet rays were unsuccessful. The authors, however, considered it possible, by more intense rays than those used and longer exposure, to sterilize milk in this way, although the method would not apparently be capable of practical application.

The significance of streptococci in milk, P. G. HEINEMANN (*Jour. Infect. Diseases, 3 (1906), No. 2, pp. 173-182, pls. 3*).—This is the full report of investigations of which an abstract has already been noted (E. S. R., 17, p. 800). The three plates show the growth of *Streptococcus pyogenes* and *S. lacticus* from two sources on serum broth, lactose broth, and litmus milk.

Streptococci and leucocytes in milk, W. G. SAVAGE (*Jour. Hyg. [Cambridge], 6 (1906), No. 2, pp. 123-138*).—The methods employed are described. In the counting of leucocytes the author makes use of the Thoma-Zeiss blood-counting apparatus in much the same manner as previously described by Doane (E. S. R., 17, p. 181). One cc. of milk is diluted with about 20 cc. of Toisson's fluid and centrifuged for 10 minutes at 1,800 revolutions per minute. The cream is then broken up with a glass rod and the mixture is again centrifuged for a second period of 10 minutes after which the fluid is aspirated off to the 1 cc. mark. After thoroughly mixing the remaining 1 cc. a sufficient quantity is placed in the Thoma-Zeiss apparatus and the preparation examined in the same way as in the enumeration of blood corpuscles.

When the counting is done by fields, the author estimates the number of leucocytes per cu. mm. of milk by the formula $\frac{56,000\ y}{11d^2}$, in which y equals the average number of leucocytes per field, and d the number of squares of the blood counter which just spans the diameter of the field. The methods of counting leucocytes in dried and stained preparations used by Stokes and others were found very unsatisfactory.

Samples of milk from individual cows and also of mixed milk were examined. The results showed that streptococci were very frequently present. In the milk of individual cows streptococci were present in 42.5 per cent of the samples when 1 cc. of milk was used in the examination, and invariably present in the mixed milk. In all they were present in 45 out of 68 samples examined, or 66 per cent. As all of the cows were apparently healthy, the results are considered as showing clearly that streptococci as a class are very prevalent in pure milk. The study of the streptococci isolated showed 12 types, the characters of which are given.

Leucocytes were present in every sample, ranging in numbers from 35 to 4,380 per cu. mm. in samples from individual cows and from 21 to 1,980 in mixed milk. Contrary to conclusions reached by Bergey (E. S. R., 16, p. 699), the author's results show no connection between the numbers of pus cells and streptococci. The author states that he can not differentiate between a leucocyte and a pus cell, and that he is not prepared at present to lay down an arbitrary standard as to what number of leucocytes in milk per cu. mm. is to be designated pus.

Bacillus coli, considered as a definite indicator of contamination, was found in 17.5 per cent of the samples of milk from individual cows, in 36 per cent of the samples of mixed milk examined within 3 hours from the time of milking, and in 94 per cent of mixed and market samples not examined promptly.

The leucocyte test of milk, R. TROMMSDORFF (*München. Med. Wchnschr., 53 (1906), No. 12, pp. 541-543*).—In estimating the leucocyte content, 5 cc. of milk was centrifuged and the sediment measured in a graduated sedimentation tube.

In the majority of cases the leucocyte content determined in this way varied from mere traces to 0.4 cc. per liter. In some instances, however, the sediment amounted

to 2.5 per cent or more. Physical examinations of the udder and the leucocyte test were made with a large number of cows, the results being considered very favorable to the latter method. The author considers the leucocyte test practical and suggests as a result of his investigations that mixed milk containing more than one volume per million of sediment should be considered as indicating mastitis, and that a higher leucocyte content than 2 volumes per million should be considered as establishing with certainty the presence of disease in the udder. The streptococci which were always present in large numbers when the leucocyte content was high were found, in many cases, to be pathogenic to mice. The prevention of the sale of such milk is, therefore, considered very desirable.

The milk of cows affected with mastitis was found to possess an unusually high bactericidal power which was considered as probably related to the high leucocyte content. The more detailed results of these investigations which were conducted in conjunction with Dr. Rullmann will be published later.

The Tromsdorff leucocyte test for milk, W. RULLMANN (*Milch Ztg., 35 (1906), No. 14, pp. 157, 158*).—Attention is called to this test which consists in centrifuging a small quantity of milk and determining the amount of the sediment. The results so far obtained are considered very favorable to the method.

Sodium chlorid in milk, C. PORCHER (*Rev. Gén. Lait, 5 (1906), Nos. 8, pp. 173-178; 9, pp. 193-198*).—The author concludes, from the results of his studies, that sodium chlorid is one of the most variable elements in milk, and that its presence in greater or less amounts does not depend directly upon food, but upon purely physical processes—the regulation of the osmotic equilibrium. He would, therefore, separate sodium chlorid from the other mineral constituents of milk, the presence of which is probably more or less directly related to the chemical function of the glandular tissue. It is noted that a maximum of sugar in milk is associated with a minimum of salts, especially sodium chlorid and vice versa.

Comparative study of milk tests, C. HUYGE (*Bul. Agr. [Brussels], 21 (1905), No. 6, pp. 1096-1110*).—Of six methods of determining fat the Gerber method was given the preference as the result of a number of comparative tests. Considerable attention was paid to the estimation of cream separated spontaneously or by means of the centrifuge. While the results are not strictly accurate, the creamometer is considered very valuable for farm tests.

Contribution to the knowledge of the distribution of lactic ferments outside the milk, C. BARTHEL (*Rev. Gén. Lait, 5 (1906), Nos. 10, pp. 223-233; 11, pp. 246-251; 12, pp. 265-272*).—The literature of this subject is briefly reviewed and extended observations are reported.

According to the author's results, *Bacterium lactis acidi* is found on all species of plants growing on cultivated lands. On the contrary, it is not found on plants distant from cultivated fields, or, if found, is in a very weakened condition. The same statement applies to the presence of this organism in the soil. *B. coli commune* and *B. lactis aerogenes*, especially the first, are found on all living plants whether coming from cultivated fields or from the forest. They are also found everywhere in the soil. *B. lactis acidi* is found, naturally, everywhere in the stable, in the air, in the water, and different feeding stuffs, and in the manure. It is thus very natural that the milk becomes infected as soon as it is drawn. The most rigorous precautions are, therefore, necessary in order to lessen the amount of contamination during milking.

A municipal milk service for London, L. PARKES (*Pub. Health [London], 18 (1906), No. 7, pp. 439-441*).—After raising objections to present systems of municipal milk depots, such as the want of effective supervision over the production of the milk, the necessity of pasteurization and sterilization when the milk reaches the city, and the added cost making the business unprofitable, the author makes suggestions concerning a municipal milk service for London.

Cleansing of milk vessels: Relative value of washing powders, A. H. STEWART (*Amer. Med., 11 (1906), No. 7, pp. 241-244*).—An investigation was made of the methods employed in cleansing bottles and cans used for milk.

Several methods were found in use, (1) rinsing out cans or bottles with cold water, which, while almost necessary to remove the remaining milk, is considered as leaving the can almost as dirty as before; (2) washing bottles and cans with a hand brush and a solution of one of the various washing powders, the method most often used by the small dealer, which was frequently found to be done carelessly and without hot water, or a washing-powder solution strong enough to be satisfactory; (3) washing with machines with a revolving brush and solution of washing powder and rinsing in water, the results of which method were considered unsatisfactory from a bacteriological standpoint; (4) throwing a jet of live steam into inverted cans, which method frequently serves to fix the dirt already in the can and does not destroy the bacteria; (5) washing by means of large machines constructed to throw powerful streams of hot washing-powder solutions into the bottles, and followed by boiling water, which method, the author says, was investigated thoroughly and found most satisfactory; and (6) washing with soap and water and sterilizing in a steam box or autoclave, which is a fairly good method, but applicable only when a comparatively small number of bottles are to be cleaned daily.

The fifth method mentioned is considered capable of cleansing 95 per cent of the bottles perfectly. The author states that 500 bottles have been watched going through this kind of machine without finding one that had not been thoroughly cleansed. "This is probably the only rapid practical method of sterilizing and cleansing milk vessels."

Several washing powders were compared as regards their ability to destroy bacteria and cleanse milk vessels. The germ-destroying power was found to be slight. Sodium carbonate and powders containing a large proportion of this material were found to cleanse most thoroughly and most rapidly. Powders composed of alkali and a fat cleansed well, but less rapidly.

The author considers the establishment at each milk-receiving depot in Philadelphia of a can washing and cleansing building, where all cans must be sterilized before being sent back to the farms, as the only remedy for the deplorable condition existing in that city. The advantages of such a scheme are enumerated.

The examination of pasteurized milk, P. BUTTENBERG (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 7, pp. 377-385, fig. 1*).—Tests were made of the following methods used for detecting pasteurized milk: (1) The guaiac reaction, (2) Schardinger's reaction with methylene blue and formaldehyde, (3) the reaction of Neisser and Wechsberg depending upon the reduction of methylene blue by bacteria, (4) the bacterial content, and (5) the incubation of the sample according to the method of Bonnema (E. S. R., 16, p. 1123). The data obtained in the application of these methods to samples pasteurized by the author and to commercial samples are reported in tabular form. The different methods may be readily employed under practical conditions and, when taken together, furnish much more reliable data for judging a sample than the results obtained by any one method alone.

The pasteurization of cream and the use of pure cultures in butter making, J. ARTHAUD-BERTHET, A. PERRIER, and L. DUPONT (*Rev. Gén. Lait, 5 (1906), Nos. 10, pp. 217-222; 11, pp. 241-246*).—The results of a study of butter making in the region of Isigny, France, are reported along with experiments in which pasteurization and pure cultures were employed with satisfactory results. The authors recommend pasteurization at 65° C. for 5 minutes and the use of suitable cultures.

Protest against slandering American butter, G. L. MCKAY (*Hoard's Dairyman, 37 (1906), No. 12, p. 336*).—The author contends that only a very small amount of American butter contains an abnormally high percentage of water.

Red-spotted butter, H. STADLINGER and J. PODA (*Milchw. Zentbl., 2 (1906), No. 3, pp. 97–115*).—The morphological and cultural characters of an organism isolated from red butter and designated *Bacterium butyri rubri* are reported. The organism is considered as belonging to the *Bacillus prodigiosus* group, though distinct from that species. The pigment produced by the organism was identified as prodigiosin. The most probable source of infection was through water.

On the importance of strictly anaerobic putrefactive bacteria in cheese ripening, A. RODELLA (*Centbl. Bakt.* [*etc.*], *2. Abt., 16 (1906), No. 1–3, pp. 52–56, pls. 2*).—In continuation of previous investigations (E. S. R., 16, p. 196) the author reports cultural and biochemical studies of putrefactive anaerobes capable of producing in milk cultures, caproic, valeric, and butyric acids from casein. Anaerobic propionic acid ferments will be considered in the next communication, and the importance of putrefactive bacteria in cheese making in a later article, while a more detailed discussion in the form of a monograph on putrefaction is announced.

The influence of the fat content of milk on Emmenthal cheese, O. JENSEN (*Rev. Gén. Lait, 5 (1906), No. 12, pp. 272–277*).—As a result of experiments in making Emmenthal cheese with milk containing different percentages of fat, the author concludes that when properly made the quality of Emmenthal cheese is improved with an increase in the fat content of the milk up to at least 4 per cent, and that this is due not only to the increase of the most valuable constituent in the cheese, but because the increased amount of fat favors the ripening of the cheese.

The influence of cooking on Emmenthal cheese, O. JENSEN (*Rev. Gén. Lait, 5 (1906), No. 13, pp. 299–303; Landw. Jahrb. Schweiz, 20 (1906), No. 2, pp. 154–156*).—Temperatures varying from 48 to 60° with corresponding periods of stirring decreasing from 120 to 25 minutes were studied in the manufacture of Emmenthal cheese.

The results indicate that great care should be taken to avoid using too low a temperature, for a limit is soon reached when the action of heat can not be equalized by a longer period of stirring. A lower temperature than 55° was not found satisfactory. Analyses of the cheese at the age of 4 months are reported. The use of cultures of *Bacterium acidi propionici* gave marked results at all temperatures employed, even at 60°.

Roquefort cheese, E. MARRE (*Le Roquefort. Rodez: Carrère, 1905; rev. in Rev. Gén. Lait, 5 (1906), No. 11, p. 260*).—This monograph deals with the production of milk by sheep, manufacture of Roquefort cheese, and commerce in this cheese.

VETERINARY MEDICINE.

Comparative anatomy of the domesticated animals, A. CHAUVEAU, trans. by G. FLEMING (*New York: D. Appleton & Co., 1905, enl. ed., pp. XXXVI + 1084, figs. 585*).—This edition is a revision and enlargement by S. Arloing of the author's original text-book, translated and edited, with notes by the translator. The material in the volume is arranged according to the usual scheme of descriptive anatomy and constitutes a valuable guide to the study of comparative anatomy in our farm animals.

Comparative pathology of the blood, P. MEIER (*Ztschr. Tiermed., 10 (1906), No. 1–2, pp. 1–81, pl. 1*).—The cell content of normal blood in various animals, particularly in the horse, is discussed in considerable detail for the purpose of securing data upon which to base conclusions obtained from the study of the leucocytes and red blood corpuscles in cases of disease.

The author compared the conditions found in man and animals in various diseases, including contagious coryza, croup, angina, pleuro-pneumonia, tetanus, malignant edema, ringworm, hydremia, etc. In general the morphological relations in regard to the leucocytes agree closely in man and animals. This agreement is especially close between man and the horse, and it is, therefore, believed possible to apply conclusions derived from a study of horse blood to similar conditions in man. There

appears to be an antagonism between the neutrophilous and eosinophilous cells, so that a rapid multiplication of the former reduces the number of the latter. The results obtained in a study of pernicious anemia, contagious coryza, angina, and various animal diseases are discussed in detail in connection with a bibliography of the subject.

Tumors and tumor-like lesions in the esophagus and surrounding tissue, A. W. Mörkeberg (*Maanedskr. Dyrlæger, 17 (1905), No. 7–8, pp. 209–241, pls. 2, fig. 1*).—In a classification of tumors found in the region of the esophagus in cattle the vast majority are actinomycomata. Fibromata, melanomata, and tuberculous lesions occur less frequently. Detailed notes are given on the anatomy of these tumors, their location, and the means of making a differential diagnosis.

The animal parasites of man, M. Braun, trans. by Pauline Falcke (*London: John Bale, Sons & Danielsson, Ltd., 1906, 3. ed., pp. XIX + 453, figs. 290*).—The original revised text has been considerably enlarged, corrected, and edited by L. W. Sambon and F. V. Theobald. As brought up to date in its present form, it includes an account of the life history, anatomical features, and parasitic habits of all animal parasites known to infest man. These parasites are arranged according to their usual zoological position under the heads protozoa, flat worms, nematodes, acanthocephala, leeches, and arthropods. Naturally the greater number of species of parasites infesting man belong to the last-named group.

Micro-organisms with spiral bodies, R. Blanchard (*Rev. Vét. [Toulouse], 31 (1906), No. 2, pp. 86–97*).—A description is presented of various spiral micro-organisms, including species of Spirosoma, Vibrio, Spirobacillus, Spirillum, Treponema, and Trypanosoma. The more important species of these genera are mentioned with reference to their economic importance.

The control of contagious diseases of animals, L. Hubert (*Rev. Vét. [Toulouse], 31 (1906), No. 2, pp. 104–110*).—Statistics are given on the occurrence of anthrax, foot-and-mouth disease, rabies, contagious pleuro-pneumonia, tuberculosis, and glanders. It is believed that pleuro-pneumonia will soon be eradicated by the continuation of stringent measures such as the slaughter of all affected animals and disinfection of premises. Notes are given on indemnities paid for tuberculous animals. The number of cases of glanders in France is diminishing.

Report of the State veterinarian, L. Pearson (*Ann. Rpt. Penn. Dept. Agr., 10 (1904), pp. 69–96, figs. 12*).—Brief reference is made to the work of the veterinarian in combating rabies, treating cattle affected with tuberculosis, and in the control of glanders, blackleg, anthrax, infectious abortion, hemorrhagic septicemia, calf cholera, horse mange, hog cholera, and Texas fever.

The effect of vaccination upon cattle infected with tuberculosis is discussed by the author and S. H. Gilliland (pp. 85–96). This treatment consisted in frequent inoculation with living cultures of tubercle bacilli of low virulence. A number of calves were given subcutaneous injections of tuberculin at intervals of 2 to 10 days. The treatment with tubercle bacilli of low virulence had a distinctive curative effect and in all treated animals the lesions were encapsulated, but still contained tubercle bacilli. Apparently under such treatment tuberculous lesions do not extend but may recede and finally become absorbed.

Report of the chief of the cattle bureau, A. Peters (*Agr. of Mass., 1904, pp. 251–324*).—A financial statement is presented regarding the work of the office, and tables are given showing in detail the inspection service for live stock throughout the State. As in previous years the greatest expense of the cattle bureau has been incurred in paying indemnities for cattle slaughtered for tuberculosis. Notes are also given on the prevalence of tuberculosis, glanders, *Strongylus paradoxus* and trichina in hogs, rabies, sheep scab, actinomycosis, blackleg, Texas fever, hemorrhagic septicemia, takosis, and contagious ophthalmia.

Report on the Austrian Veterinary Service for 1901 (*Bericht über das Österreichische Veterinärwesen für das Jahr 1901. Vienna: Alfred Hölder, 1905, pp. 284, pls. 14*).—A detailed account is given of the present condition of domestic animals in Austria and of the prevalence of various diseases among them, particular attention being devoted to foot-and-mouth disease, anthrax, blackleg, glanders, sheep pox, rabies, mange, hog cholera, swine erysipelas, and other infectious diseases. Statistics are presented on the losses due to such diseases, the cost of controlling them, and on veterinary education.

Poisoning of horses, cattle, and pigs with beans containing prussic acid, C. Dammann and M. Behrens (*Deut. Tierärztl. Wchnschr., 14 (1906), Nos. 1, pp. 1–4; 2, pp. 13–16*).—According to the authors' observations considerable numbers of horses, cattle, and hogs have died suddenly as a result of eating beans which in most cases came from foreign countries.

In the observations first made along this line the species was not determined. Prussic acid was found in the beans, however, by means of the usual tests for this substance, and feeding experiments showed the presence of the poison in the beans. Later a sample of beans used for feed was sent to the Berlin Botanical Garden for identification, and it was found that the sample contained *Phaseolus lunatus*, *P. vulgaris*, *Cajanus indicus*, and a species of Dolichos All of these species of beans appeared to contain prussic acid in some quantity.

Castration of females of animals other than the horse, W. Robertson (*Agr. Jour. Cape Good Hope, 28 (1906), No. 1, pp. 90–95, figs. 5*).—Notes are given on successful methods of caponizing and spaying pigs and other animals.

Experiments in serum therapy in cases of pasteurellosis of laboratory animals, J. Bridré et al. (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 2, pp. 62, 63*).—In the author's experiments it was found that rabbits could be gradually immunized by means of injections of organisms causing pleurisy and other forms of pasteurellosis. Rabbits treated in this way were not only immune to septicemia and various other laboratory diseases, but furnished a serum which protected other rabbits when inoculated in doses of 2 to 4 cc.

In the investigation of animal diseases it is quite necessary that laboratory animals be protected in order to save the time which would be lost by the sudden outbreak of infectious diseases among them. For this purpose sheep were used to furnish serum for the vaccination of laboratory animals. The normal serum of sheep was found not to possess any preventive property, but after repeated inoculation with gradually increasing doses the serum was quite effective.

Comparative study of human and animal tuberculosis, H. Kossel (*Ztschr. Tuberkulose, 8 (1906), No. 2, pp. 101–119*).—In the author's experiments, which are described in detail in this article, 27 cultures of bovine tubercle bacilli were used, and these cultures, after subcutaneous inoculation, produced a generalized tuberculosis in 32 out of 33 cattle, while similar inoculation with human tubercle bacilli caused only local lesions. The author believes, however, that man is susceptible to the bacilli which cause pearl disease in cattle. Attention is called to the biological differences which appear in the human and bovine tubercle bacilli and notes are given on the views expressed by Ravenel, Arloing, Lignières, and others in discussing the article.

Tuberculosis, W. P. McCray (*Ann. Rpt. Penn. Dept. Agr., 10 (1904), pp. 692–698*).—The symptoms and pathology of tuberculosis are described with particular reference to the work which the live stock sanitary board of Pennsylvania has done in examining cattle for tuberculosis. This board has examined and tested with tuberculin 44,801 cattle and of this number 5,869 have been condemned, destroyed, and paid for.

The histology and pathogenesis of uterine and ovarian tuberculosis in cattle, H. Fischer (*Ztschr. Tiermed., 10 (1906), No. 1–2, pp. 82–109, pls. 4*).—A

critical review of the literature of this subject is given together with details secured by the examination of 50 cases in cattle.

In this study it was found necessary to separate the cases into two classes according as the uterus or ovary was more extensively affected. In 21 cases it was found that the ovary was first attacked and that infection spread to the uterus. In 29 cases the disease appeared in a more advanced stage in the uterus and the infection was probably primary in this organ. The author believes, however, that in a majority of cases infection spreads from the oviduct to the uterus. The infection of these organs may take place as a result of contagion of tuberculosis from the outside.

Tuberculous nature of diffuse enteritis in cattle, LIENAUX and VAN DEN EECKHAUT (*Ann. Méd. Vét., 55* (*1906*), *No. 2, pp. 84–93*).—In many cases the authors have observed the coexistence of ordinary tuberculosis and enteritis. A study was made of this matter for the purpose of determining whether the enteritis observed in such cases was of tuberculous origin. In this study small experimental animals were used, as well as cattle, for inoculation purposes. It was found that the bacteria obtained from such cases of enteritis were identical with the tubercle bacillus.

Three years' experience in protective vaccination of cattle against tuberculosis by von Behring's method, STRELINGER (*Ztschr. Tiermed., 10* (*1906*), *No. 1–2, pp. 118–132*).—Attention is called to the fact that other investigators have furnished convincing experimental proof of the importance and effectiveness of von Behring's method of vaccination. The author describes in some detail experiments along this line.

The method appears to be absolutely harmless to cattle when attention is given to the most obvious requirements of the technique of the operation. In 62 cases the method was applied to calves which were already tuberculous, and among this number 49 animals appeared to be completely cured by the treatment. The tuberculin test was given to 590 cattle which had been previously vaccinated and kept under observation for a year or more. Of this number only 9 animals or 1.5 per cent reacted to tuberculin. This percentage is quite satisfactory when it is remembered that in similar herds untreated about 50 per cent reacted to tuberculin.

Vaccination against tuberculosis, DEGIVE ET AL. (*Ann. Méd. Vét., 55* (*1906*), *No. 2, pp. 76–84*).—This is the report of the commissioner appointed to make a test of the vaccination method proposed by von Behring for the control of tuberculosis. The animals, after vaccination, were tested by means of subcutaneous and intravenous inoculations as well as by feeding virus and exposure by proximity to infected animals. As a result of this test it is concluded that the vaccination recommended by von Behring does not cause tuberculosis in any case and produces a great natural resisting power toward ordinary contamination. Vaccinated animals can not be infected with tuberculosis even by the use of large doses of virulent material. In carrying out this method of vaccination on a practical scale, it is desirable to keep vaccinated animals from undue exposure to tuberculosis during the first few months after vaccination. It is also recommended that vaccination be not undertaken in stables where broncho-pneumonia prevails at the time.

The sugar-producing action of the tubercle bacillus, C. FERMI (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40* (*1905*), *No. 2, pp. 187, 188*).—The author tested the reducing power of tubercle bacillus by cultivating it in a potato medium which had previously been shown to contain no reducing reagent. In all cases positive results were obtained or, in other words, the tubercle bacillus was found to possess a reducing power.

The species of actinomyces, E. HAASS (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40* (*1905*), *No. 2, pp. 180–186*).—Specimens of actinomyces from various sources were examined with particular reference to the determination of the relationship between these forms. As a result of the author's investigations it is proposed that the group of

actinomyces be placed between Bacteria and Hyphomycetes with four genera—Corynebacterium, Actinobacterium, Mycobacterium, and Actinomyces.

The diagnosis of anthrax by means of cultures, FISCHOEDER (*Fortschr. Vet. Hyg., 3 (1906), No. 10, pp. 217–225, pls. 4*).—According to the author's experiments, which substantiated in some respects previous experiments by other investigators, it appears that under favorable conditions anthrax colonies do not develop in a form sufficiently characteristic to enable their differentiation from colonies of other micro-organisms. In fact a number of other organisms appear to develop at times in colonies almost identical in appearance with those of anthrax.

The morphological characteristics of anthrax colonies are not specific enough to allow a diagnosis to be made upon that basis alone in practice. It is often necessary, therefore, to resort to inoculation to determine the pathogenic action of suspected material in order to reach a well-founded diagnosis.

The resistance of granulations to anthrax, R. GIANI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1905), No. 2, pp. 238–241*).—The author found that cultures of anthrax when rubbed on granulating wounds were quite effectively checked in their penetration into the underlying tissues. In a few instances, however, the anthrax bacillus actually penetrated through the granulating tissue.

The properties of the antianthrax serum of Sclavo, E. CLER (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1905), No. 2, pp. 241–247, pl. 1*).—It was found that anthrax bacilli obtained from blood are so affected by the antianthrax serum of Sclavo that they possessed the property of fixing alexins. The author gave particular attention to a study of the relation between white blood corpuscles and the anthrax serum.

Cultural characters of the blackleg bacillus, T. SMITH (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1905), No. 1, pp. 26–31*).—The author calls attention to the fact that in his experiments the blackleg bacillus in peptone bouillon without meat, sugar, or any particles of animal organs, sets free from 50 to 100 per cent of the gas from dextrose and lactose but none or very little from saccharose. The composition of this gas was approximately 2 parts hydrogen for 1 of carbon dioxid. Milk coagulated within a few days.

Report on the preparation of rinderpest protective serum, A. LINGARD (*Calcutta: Supt. Govt. Printing, India, 1905, pp. 116*).—Various methods have been used in protecting cattle against rinderpest, and among the schemes of vaccination the author describes those in which use is made of bile, serum and virus, serum alone, defibrinated blood, normal bile, vegetable seeds, extracts from testes, and other reagents. The methods have also been classified as slow or rapid according as the process is hastened or not.

Of the various methods used at Muktesar on plains' cattle, the best and most economical results were obtained by using the rapid process which consists in injecting 6,000 cc. of virulent rinderpest blood. The animal is bled 15 days after the subsidence of the inoculation fever and after 78 days is again inoculated and bled. When large doses of virulent rinderpest blood are injected into plains' cattle, a weak or attenuated serum is obtained which sometimes possesses the highest protective power at the first bleeding. The protective value of a serum was found to depend considerably on the degree of severity of the initial attack of rinderpest. Apparently there is no constant relation between the protective value of a serum and its specific gravity or the total amount of proteids which it contains. Notes are also given on rinderpest in camels and methods of controlling it.

Specific papular stomatitis of cattle, a disease resembling aphtha, R. OSTERTAG and BUGGE (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1905), No. 1, pp. 3–20, pl. 1*).—A disease appeared among cattle in Friedrichsfelde during which symptoms developed which closely resembled those of foot-and-mouth disease. The body temperature, however, was only 39° C. No salivation was observed either during or after eating.

A number of sharply defined papules were observed on the hard gums and mucous membrane of the cheeks. These areas were somewhat larger than lentils. In some cases similar areas were observed on the underside of the tongue 1 to 1½ cm. in diameter. When material was taken from such areas and used in the inoculation of calves, a reddening and swelling at the point of inoculation were observed within 2 to 4 days and papules appeared after 13 days. The disease is therefore infectious. In further experiments it was found that the defibrinated blood is virulent but not the blood serum. By placing healthy animals in contact with diseased ones it was found that the disease is transmitted spontaneously. Apparently the micro-organism is filterable and ultramicroscopic.

The disease in question can not be identical with sporadic aphtha or foot-and-mouth disease since no vesicles appear at any time and the disease is confined entirely to the mouth cavity. The skin and hoofs appear never to be affected.

Abortion in cattle, W. Robertson (*Agr. Jour. Cape Good Hope, 27 (1905), No. 5, pp. 624–628*).—The causes of noncontagious and contagious abortion are briefly outlined and notes are given on the treatment of the latter form of the disease. In this disease the only effective treatment is preventive and aims at the eradication of the organism which causes the disease. The fetus and fetal membranes should be burned and all parts of the cow liable to contamination should be treated with a solution of corrosive sublimate or some other antiseptic.

Report of the Swiss Veterinary Society on granular contagious vaginitis, E. Hess (*Landw. Jahrb. Schweiz, 19 (1905), No. 6, pp. 338–445*).—A special commission was organized among the Swiss veterinarians to make a study of contagious vaginitis of cattle in all its relations.

This committee undertook the collection of statistics which indicate the distribution of the disease in Switzerland, the percentage of cattle affected, the seriousness of symptoms, the means of dissemination of the disease, and its treatment. In some localities from 40 to 60 per cent of cattle were affected. Antiseptic treatment in the way of general washes is recommended by nearly all of the veterinarians on the committee as the most successful means of controlling this disease. Among the remedies thus applied mention should be made of carbolic acid, creolin, lysol, ichthyol, boric acid, silver nitrate, bichlorid of mercury, copper sulphate, acetate of lead, Bacillol, etc.

The periodical disinfection of the premises where the disease has occurred or may be expected to occur is recommended as an effective measure in preventing the spread of the plague. It is recommended that contagious vaginitis be included among the diseases of which notification must be given and that infected animals should not be used for breeding purposes.

A bacilliform piroplasmosis of cattle, and an intestinal coccidiosis in Tunis, E. Ducloux (*Bul. Dir. Agr. et Com. [Tunis], 9 (1905), No. 97, pp. 573–578*).—A bacillar parasite was observed among cattle in a large number of cases of piroplasmosis in certain localities in Tunis. Autopsies made on a number of cases showed that certain parasitic worms, especially *Strongylus contortus* and *Bunostomum phlebotomum*, were present. The action of the parasitic worms appeared to cause hemorrhagic injuries in the intestinal walls, and the author suggests that their presence may render infection with piroplasmosis more easy and more frequent than it otherwise would be.

The study of the causes of intestinal coccidiosis in Tunis showed that in the intestines there were numerous lesions containing masses of fibrin, coagulated blood, and a species of Coccidium in enormous numbers. This organism is described, and notes are given on its different developmental forms.

Experiments with Jensen's polyvalent serum for infectious diarrhea of calves, J. Jansson (*Svensk Vet. Tidskr., 10 (1905), No. 12, pp. 486, 487*).—Jensen's

serum was used in attempting to prevent the development of calf diarrhea in 21 cases, with good success in all except four of the calves. In the 4 cases which were without result the vaccination was not given until 2 or 3 days after birth. It is recommended that in order to prevent the disease with certainty the serum should be injected immediately after the birth of the calf or at least as soon as possible.

Further experiments in the disinfection of cattle cars with aqueous solutions of formaldehyde, J. SCHNÜRER (*Ztschr. Infectionskrank. u. Hyg. Haustiere, 1 (1905), No. 1, pp. 32–44*).—It was found in these experiments that a 1 per cent solution of the gas in the air within the car was sufficient for disinfection. In order to obtain this, 2½ liters of commercial formalin were dissolved in 100 liters of water, and of this mixture 60 liters were used for each car, the cars being previously cleaned as thoroughly as possible by mechanical means.

Diseases of lambs, T. W. CAVE (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 12, pp. 1236–1246*).—Particular attention is given in this article to a discussion of the infestation of lambs with tapeworms, lungworms, the parasite of gid, and stomach-worms.

Sheep pox on the Schönau estate near Leipsic, NOACK (*Deut. Tierärztl. Wchnschr., 14 (1906), No. 3, pp. 25, 26*).—Notes are given on an outbreak of sheep pox which showed symptoms of unusual virulence. In a herd of 630 sheep 190, or 30 per cent, died. In nonfatal cases recovery took place after 3 to 5 weeks. Nearly all of the animals were affected.

Experimental myasis in goats, with a study of the life cycle of the fly used in the experiment, and a list of some similar noxious Diptera, F. C. WELLMAN (*Jour. Med. Research, 14 (1906), No. 2, pp. 439–446*).—A species of fly closely resembling *Sarcophaga regularis* was captured in some numbers and allowed to attack a goat kept confined for purposes of observation. The fly is vivaporous and deposited a large number of larvæ in the nasal passages of the goat, causing a serious illness. The life history of this species is worked out and notes are given on various other species of Oestridæ, Sarcophagidæ, Muscidæ, and Anthomyidæ.

The control of swine plague, FOTH (*Berlin. Tierärztl. Wchnschr., 1906, No. 4, pp. 57, 58*).—On account of the wide distribution of swine plague in Germany it is necessary to take strict measures for its control. The official diagnosis of swine plague is based largely on the clinical demonstration of the infectiousness of the disease. This diagnosis is to be supported by the post-mortem findings, and in doubtful cases by bacteriological cultures. The veterinary police are largely concerned in determining the character of the outbreak and in separating the acute and chronic cases, since these two classes require different treatment. In chronic cases of swine plague no restriction is necessary, provided the animals are to be slaughtered, while all traffic in such animals for breeding purposes should be prohibited.

Health factors in horse management, S. S. CAMERON (*Jour. Dept. Agr. Victoria, 3 (1905), No. 10, pp. 725–732*).—Attention is called to the various evidences of the beginning of disease which may appear in horses. Among the predisposing causes mention is made of overstocking, unsuitable food and water, environment, and hereditary tendencies. In the prevention of the disease it is obvious that particular attention should be given to these points.

Loss of horses in Kansas, F. S. SCHOENLEBER (*Industrialist, 32 (1906), No. 17, pp. 263, 264*).—Horses are occasionally killed by eating corn or corn fodder affected with molds, particularly *Aspergillus glaucus*, which often follows the attacks of the bollworm in corn. The treatment of this trouble is unsatisfactory, but some benefit may be derived from the administration of purgatives and iodid of potash in 1 dram doses.

Pathogenesis and transmissibility of latent glanders, A. BONOME (*Patogenesi e Trasmissibilità della Morva Chiusa. Padua: Ist. Anat. Patol. R. Univ. Padova, 1905, pp. 115*).—The present report contains an account of what were probably the

most extensive experiments ever carried out in feeding glanders bacilli to horses and experimental animals to determine the method and extent of infection through the alimentary tract.

The author fed the bacilli in capsules sealed so that the glanders bacilli could not escape until the capsule was digested in the stomach. It was found possible to produce latent glanders in horses as a result of this method of infection. The disease, however, was not very virulent and sometimes persisted for a year or even 13 months without giving any evidence of its existence. Such animals did not give a mallein reaction or show any increased agglutinating power of the blood toward glanders bacilli. Care was exercised in all cases that the capsules were not broken in passing through the esophagus. It was found in experiments with guinea pigs and other animals that the digestive juice exercises a considerable effect upon the glanders bacillus, hindering its development and reducing its virulence.

One of the reasons why glanders produced through the agency of the alimentary tract may require a long time to become established is found in the fact that the glanders bacilli are so greatly diluted with large quantities of food material, water, and digestive juices in the alimentary tract. Nevertheless, infection does take place from bacilli in the alimentary tract causing primitive foci of infection in the mesenteric glands. The specific localization of glanders bacilli in the lungs in such cases is a secondary process. During the author's experiments it was shown that glanders bacilli are eliminated in the urine of infected animals.

Etiology of pneumonia in horses, LORENZ (*Berlin. Tierarztl. Wchnschr., 1906, No. 5, pp. 73–75*).—An outbreak of this disease gave the author an opportunity to study its symptoms and also to carry on some investigations regarding its etiology. A micro-organism was found in the form of a bacillus with thickened ends, and this bacillus occurs under other developmental forms, including diplococci and streptococci. These organisms were not to be seen except by the use of the most approved microscopic apparatus. The author believes that the organism may safely be considered as the cause of pneumonia.

Observations on the blood of horses infected with tetanus, M. E. TABUSSO (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40 (1906), No. 3, pp. 311–317*).—In this study particular attention was given to the hemolytic and agglutinative power of the blood of horses infected with tetanus. It was found that a temperature of 55° C. destroyed the hemolytic power of the serum.

Treatment of tetanus in race horses, CHAPARD (*Bul. Soc. Cent. Méd. Vét., 83 (1906), No. 2, pp. 64–70*).—It has frequently been observed that in thoroughbred horses of nervous temperament tetanus is usually fatal. The author finds, however, that under certain circumstances this peculiar susceptibility to tetanus may be of value in treating the disease, for, in some instances, the first symptoms appear so promptly that the disease is detected in time to prevent its further development by antiseptic treatment of the wound where infection took place. In one case treatment of this sort combined with the use of antitetanic serum, chloral, and caffein brought about a complete recovery within 10 days.

Nodules in the mucous membrane of the stomach in horses, A. TOMIOLO (*Gior. R. Soc. ed. Accad. Vet. Ital., 55 (1906), No. 1, pp. 5–7*).—In an inspection of horse meat in an Italian abattoir the author reports the finding of nodules in the gastric mucous membrane of an otherwise healthy horse. These nodules contained a worm identified as *Filaria spiroptera*.

Spirillosis in the horse in French Guinea, G. MARTIN (*Compt. Rend. Soc. Biol.* [*Paris*], *60 (1906), No. 3, pp. 124–126, fig. 1*).—Symptoms closely resembling those of trypanosomiasis were observed in a horse in the blood of which numerous spirilla were found associated with the red blood corpuscles. When this blood was used for the inoculation of chickens no results were observed, but in sheep a fever developed within 37 days and trypanosomes appeared in the blood.

Cilia and transverse divisions in the spirillum of fowls, A. Borrel (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 3, pp. 138-141, figs. 2*).—In order to stain the cilia of this organism it was found necessary to make use of Löffler's method. Notes are given on the appearance of the cilia and on divisions which occur in the spirilla, which are well illustrated.

Preventive vaccination against distemper of dogs, Meis (*Berlin. Tierärztl. Wchnschr., 1906, No. 3, p. 44*).—In the author's experience with Piorkowski's serum in the treatment of dog distemper no beneficial results were obtained, and cases are cited in which other investigators have likewise had negative results.

Piorkowski's serum for dog distemper, Lange (*Berlin. Tierärztl. Wchnschr., 1906, No. 4, pp. 59-61*).—The author tested the value of this serum in the treatment of 8 cases of dog distemper. While the results obtained are not a sufficient basis for general conclusions the author believes that if administered in the early stages of the disease the serum gives favorable results. In chronic cases, especially such as show nervous symptoms and heart weakness, the serum was of distinct benefit. The author recommends the use of at least 10 cc. as a dose.

Is rabies infectious during the incubation stage? W. Koppitz (*Berlin. Tierärztl. Wchnschr., 1906, No. 2, pp. 19, 20*).—Data are presented regarding rabies in animals and man, from which it appears that the disease is infectious even in the incubation stage. It is therefore recommended that legal regulations should include the destruction of dogs and cats which have come in contact with rabid animals immediately, before the symptoms of the disease appeared in the latter.

Transmission of rabies through superficial wounds and the value of local treatment, V. Galtier (*Jour. Méd. Vét. et Zootech., 57* (*1906*), *pp. 19-21*).—Some doubt is occasionally entertained regarding the depth of the wound necessary for producing infection from rabies. The author finds that infection may take place through the most superficial injuries of the skin.

Rabies in rats, with observations on this disease in various species of mice, B. Galli-Valerio (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40* (*1905*), *No. 2, pp. 197-204; 40* (*1906*), *No. 3, pp. 318-331, figs. 2*).—The possibility of rats and mice acting as agents in the distribution of rabies has frequently been suggested by different investigators.

The author tested this matter in a number of species, including *Mus rattus, M. decumanus, M. musculus,* and *M. sylvaticus.* Detailed notes are given on the inoculation tests made by the author and the subsequent progress of the disease. As a result of these experiments it is concluded that a number of rodents may be concerned in the transmission of rabies and that the virulence of the virus may be somewhat increased by these animals. The bite of small rodents may therefore become very dangerous. *Mus rattus* was found to be well adapted as a laboratory animal for the rapid preparation of virulent rabies virus.

The relation between fowl plague and rabies, W. Rosenthal (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40* (*1905*), *No. 2, pp. 204-206*).—In the author's study of this disease it was found that subdural inoculation of fowls with the virus of fowl plague produced death within a short time with violent symptoms resembling rabies. It is believed that some relationship exists between rabies and fowl plague.

Prosthogonimus cuneatus in hens' eggs, K. Wolffhügel (*Ztschr. Infektionskrank. u. Hyg. Haustiere, 1* (*1905*), *No. 1, pp. 21-25*).—In the white of the hens' egg 4 specimens were found of a trematode worm belonging to the species *Prosthogonimus cuneatus.* They were below the average in size, perhaps on account of the unusual situation for these parasites. In the same egg a small amount of food material was found which had become inclosed within the egg shell during the formation of the egg. Attention was called to the possibility of such parasites gaining entrance to hens' eggs during their formation.

RURAL ENGINEERING.

Irrigation on the farm, A. S. Kenyon (*Jour. Dept. Agr. Victoria, 3 (1905), No. 10, pp. 681-692, pls. 2, figs. 3*).—A description of local methods of irrigation at Doncaster, a fruit-growing district 10 miles from Melbourne.

The water for irrigation in this district is usually stored in small reservoirs built across gullies or on hillsides by the farmers. The author describes methods and details of construction. He advises "fallowing, with subsoil stirring, and frequent harrowing of the surface to conserve and carry forward much water from one season to the next;" but shows that "each farmer can carry out for himself works providing some small amount of irrigation, utilizing for that purpose water which otherwise would have been mainly dissipated in the air without going into the ground for use by the plants."

The duty of water varies from 2 in. for some kinds of trees to 36 in. for perennial fodder crops such as alfalfa. Good drainage is found to be essential on irrigated lands. The annual rainfall is about 26 in.

The irrigation of La Campine, T. Lebens (*Separate from Ann. Trav. Pub. Belg., 1897, No. 5, pp. 55, figs. 16*).—This report, written by the engineer in charge, describes the territory concerned, the former efforts to reclaim it and provide canals for transportation, the present system, and methods of applying water.

The entire area involved is about 5,000 acres. The writer points out the difficulty of using the same canal for both transportation and irrigation, and concludes: "Where continual navigation must be provided for it will always be wise to avoid a canal serving the double purpose of navigation and irrigation. It is hard to reconcile the requirements of industry and of farming." The report includes a technical discussion of water measurements, and four folding plates are given showing modules, distributing systems, and a map of the canals.

Notes on irrigation in South Africa, C. D. H. Braine (*Transvaal Agr. Jour., 4 (1905), No. 13, pp. 8-21*).—A paper read before a scientific society in Johannesburg for the purpose of encouraging the practice of irrigation in South Africa. The author discusses the duty of water and the problem of alkali or "brak" soils, drawing largely on American and other sources in the absence of local data.

By comparison with similar conditions a duty of 285 acres per cubic foot per second is estimated. The interesting local contribution is a table of land values for dry and irrigated lands in the Cape Colony. Dry land runs from 4s. to £12, averaging roughly £3 10s.; while irrigated land is quoted as high as £250, a rough average of the quotations being £38 per acre. The author concludes that £20 per acre may be safely invested in irrigation works, but urges that only the most promising schemes should as yet be attempted, leaving the larger projects to develop later after more experience has been gained.

The work of the hydrographic branch of the Geological Survey (*U. S. Geol. Survey Ann. Rpt., 26 (1904-5), pp. 160-224, pl. 1, fig. 1*).—A brief statement of the fields covered and of the work undertaken in all parts of the United States.

The work of the Reclamation Service of the Geological Survey (*U. S. Geol. Survey Ann. Rpt., 26 (1904-5), pp. 249-299*).—A summary of the projects undertaken under the Reclamation Act, giving the location, approximate area of land, and approximate cost of each.

Contributions to the study of drainage, E. Risler and G. Wery (*Ann. Inst. Nat. Agron., 2. ser., 4 (1905), No. 1, pp. 23, dgms. 4*).—The measurements reported in this article were made in the years 1867-1876 on a plat of ground carefully selected for "rigorously normal conditions." They show the relations between rainfall, drainage, evaporation, and temperature of the air. A table covering the years from 1873 to 1876 is given showing the daily rainfall and runoff of the drains.

"The quantity of water discharged by the drains is lowest during the active period of vegetation from April to September," due apparently to the transpiration by plants, and does not closely follow increased rainfall. The average monthly discharges for ten years are platted with the rainfall, temperature, and evaporation, showing that the drainage increases as temperature and evaporation decrease, the maxima occurring in December and March. But annual means of these quantities platted for a 10-year period show similar curves throughout.

The work rests on the supposition of an impervious subsoil, evaporation being taken as the difference between rainfall and the combined loss by drainage and transpiration, the latter being obtained by weighing the dry matter produced and multiplying by empirical constants as determined by M. Risler.

Sedimentation: Its relation to drainage, J. W. Dappert (*Engin. News, 55 (1906), No. 5, pp. 125, 126*).—An abstract of a paper presented before the Illinois Society of Engineers and Surveyors in January, 1906.

From his experience with over a hundred drainage districts the author has found that open drains are invariably subject to filling up with sediment, from the wash of high-land streams, or from the sloughing and caving of banks, regardless of the grades employed. He recommends as preventives that ditches be dug wider and deeper than required, to allow for sloughing of the slopes; that tile-drains should be given several feet outfall into the ditch; that curves be avoided, and waste banks be put well back from the edge of the ditch; that concrete walls be used at tile outlets and where surface water enters, and that willows and other water-loving trees should be cut out. Regular inspection and repairs are indispensable.

In conclusion he adds: "With all these things done, and even well done, the open ditches will yet require frequent recleaning, but their period of efficiency can be greatly extended by their proper care and management. Lastly, I reiterate, do not build an open ditch where a tile-drain, pipe, or conduit can possibly be employed."

Proceedings of the Second Annual Iowa State Drainage Convention (*Ames: Iowa Drainage Assoc., 1905, pp. 65, figs. 7*).—This report includes a paper by C. G. Elliott on drainage assessments, damages, and taxes, and the relation of drainage projects to roads and railroads; an address by R. M. Wright on the new Iowa drainage law, with particular reference to the constitutionality of the exercise of eminent domain by drainage systems; a paper by A. Marston on road drainage, describing the work of the State highway commission; an address by D. A. Kent on tile drainage, especially for corn lands; an article by L. E. Ashbaugh on the reclamation of meandered lake beds by drainage; and a paper on the relation of soil to underdrainage, by W. H. Stevenson.

Third report on the highways of Maryland, A. N. Johnson (*Md. Geol. Survey [Rpt.], 5 (1905), pp. 145–218, pls. 4, figs. 4*).—This report includes a progress report of work done by the counties under the direction of the State geological survey, cost data for road building in different localities, an account of laboratory tests of road materials, and a set of standard specifications for earth, macadam, and telford roads.

A new method for tensile tests of cement is used, in which the cement is molded in the form of a ring, which is broken by hydraulic pressure applied by expanding a rubber tube inside the ring, in a machine of special design. An outline of a suggested county-road law is given, providing for three elected county road commissioners and a county road engineer with a permanent staff of supervisors.

Building the new barn, A. P. Ketchen (*Rpt. Farmers' Insts. Ontario, 10 (1904), pt. 1, pp. 82–95, figs. 8*).—The author considers in a popular manner the approved methods of building foundations, basement walls, doors, windows, and floors for a large barn. The question of ventilation is fully discussed.

Machinery in agriculture, Stange (*Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 4, pp. 599–603*).—A review of a work by Dr. Alex. Lang (Berlin: Geo. Siemens, 1904).

Statistics showing the distribution of machinery of various kinds among farms of different sizes are given, indicating that few farms under 12 acres use farm machinery (power machines, seeders, manure spreaders, and mowers), and less than half of those from 12 to 50 acres. Dr. Lang has prepared cost data showing the actual saving in manual labor effected by the use of machines, having collected information from farmers. It is pointed out that experiment station tests fail to show the actual difficulties encountered in various soils and with unskilled management.

A gasoline-motor-propelled roller (*Sci. Amer. Sup., 61 (1906), No. 1571, p. 25172, fig. 1*).—A small and compact 3-ton roller which can be weighted with 10 cwt. of water by filling the back roller. Two speeds are provided, and the machine is readily reversed, making it adaptable to all kinds of road work. It is made in England, and is said to be the first application of gasoline for a roller.

Producer gas and gas producers (*Tradesman, 54 (1906), No. 9, pp. 114, 115*).—A paper read before an engineers' society by S. S. Wyer, giving an outline of the origin of producer gas, and modern methods of making and cleaning it for use in gas engines. The writer believes that "it presents the easiest and most practical solution of the elimination of the smoke nuisance. It will also show a marked economy in labor, fuel, and water consumption, standby and distribution losses, and the handling of peak loads . . . and the time will soon come when we will have producer gas locomotives and portable engines."

AGRICULTURAL EDUCATION.

Second International Congress of Agricultural Education (*2. Cong. Internat. Enseig. Agr., 1905, vols. 1, Raps. et Doc. Prél., pp. 692; 2, Compt. Rend., pp. 163*).—This is a report in two volumes of the work of the Second International Congress of Agricultural Education, held at Liège, Belgium, July 28–29, 1905.

Volume 1 contains reports and preliminary documents relating to the work of the 4 sections: (1) Higher agricultural education, (2) secondary agricultural education, (3) popular agricultural education, and (4) various means of disseminating information concerning agricultural science. In the first and third sections are given reports, opinions, and resolutions presented or adopted at 7 preceding international congresses of agriculture and at the First International Congress of Agricultural Education, held at Paris in 1904. In the section on higher agricultural education 35 papers were presented by delegates representing 14 countries of Europe, the United States, Japan, and the German colonies. In these papers are discussed systems of agricultural education; the work of particular agricultural institutions; agricultural courses in general; and particular phases of instruction in agriculture, such as agricultural mechanics, economic entomology, zootechny, tropical agriculture, rural economy, zoology as applied to agriculture, etc.

The papers presented at the section on secondary agricultural education differ materially from those presented at the first section, in that only one of the 11 papers discusses the work of a particular institution (the Provincial School of Agriculture, Barcelona, Spain). The other papers are taken up with discussions of the educational value of secondary courses in agriculture, desirable features of such courses, qualifications of teachers, agricultural schools for women, etc.

At the section on popular education 20 papers were presented. These discuss such topics as traveling schools, agricultural instruction in primary schools, courses for farmers, courses in agriculture for soldiers, and the service of agronomes. The papers presented at the fourth section are devoted to the discussion of reading circles, agricultural libraries, agricultural journals, lantern slides, lectures, and other means of disseminating information.

Volume 2 of the report is taken up with the proceedings of the congress.

What a university farm is for, L. H. BAILEY (*California Sta. Circ. 15, pp. 4*).—An excerpt from an address previously referred to editorially in this journal (E. S. R., 17, p. 216).

The prospect for education in horticulture, L. H. BAILEY (*Reprinted from West. N. Y. Hort. Soc. Proc., 51 (1906), pp. 7*).—A paper presented before the Society at its annual meeting in January, and published as a separate from the proceedings.

The author holds that at present our colleges are trifling with the subject of horticulture and teaching those things that are easily demonstrable rather than entering into the core of the matter. The college department of horticulture should have at least three strong divisions—pomology, floriculture, and the nursery business. The laboratory work in each of these departments should cover the whole theory and process of the given art. The pomological division should be a laboratory of perhaps 50 acres of actual orchards, in which every phase of the work from start to finish might be in natural operation. Floriculture as well as the nursery business should be taught by men not only thoroughly grounded in the principles of these subjects, but skilled on the craft side as well.

The manufacturing side of horticulture, such as canning, preserving, and evaporating vegetables and fruits, making jellies, juices, and other secondary products, is not yet taught in any institution, and sooner or later must form a part of the instruction in the department of horticulture. The higher institutions of learning, it is held, should teach the trades, or teach in preparation for them, as well as the professions, providing, always, that the method be such as to educate broadly at the same time.

Farmers' institutes (*Ohio Sta. Circ. 44, pp. 4*).—A list of station officers and the subjects each is prepared to discuss at farmers' institutes.

Why the friends of agricultural progress believe that agriculture should and will be taught in the public schools, A. C. TRUE (*California Sta. Circ. 17, pp. 14*).—A paper read at the joint session of the California Teachers' Association and the State Farmers' Institute at the University of California, December 26–29, 1905.

The subject is discussed from two points of view: (1) The economic, social, and educational needs of agriculture and agricultural people as related to the present civilization, and (2) the pedagogical requirements of a school system which shall be adapted to the masses of people in a democratic and industrial State and to the symmetrical culture of the mind and body of the human child.

Agriculture in the common schools, J. H. BLUFORD (*South. Workman, 35 (1906), No. 2, pp. 107–111*).—An address delivered before the North Carolina Teachers' Association at Greensboro.

Elementary agriculture, A. B. GRAHAM (*Normal Instr. and Teachers' World, 15 (1906), No. 4, pp. 9–11, figs. 5*).—This is a plea for nature study and agriculture in the rural school. It includes a discussion of the nature of work to be undertaken, suggestions for correlating agricultural work with geography, arithmetic, language, drawing, and the social life of the pupils, and hints concerning the training of teachers for such work.

Teaching of agriculture in public schools, T. L. LYON (*Univ. [Nebr.] Jour., 2 (1906), No. 5, pp. 6, 7*).—After commenting briefly on the lack of instruction in rural schools relating to the lives and occupations of the pupils, the writer gives two reasons why agriculture should be taught in high schools. "First, it contains the material with which to build a course of study second to none in educative and esthetic value; and, second, it may treat of a line of work vastly more practical and tangible than any other to the agricultural people of our State."

Instruction concerning soil and soil moisture is mentioned as of the greatest importance for Nebraska conditions, this to be followed by some attention to field crops, stock raising, dairying, and horticulture, keeping in mind that special emphasis should be given to those phases of agriculture most in vogue in the homes of the particular parts of the State in which the students live. Well-directed laboratory

work is mentioned as one of the means whereby school work may be freed "from its mechanical grind—its repetition of words and sentences without the thought content." General suggestions concerning the nature of laboratory work are given.

The advisability of agricultural education in elementary schools, L. H. BAILEY (*Agr. of Mass., 1904, pp. 93-120*).—This includes an address by L. H. Bailey, with discussion.

The first speaker, in giving reasons why young men leave the farm, suggested lack of business opportunity on the farm, ambition for large things, opportunity to work for others without financial risk, the attraction of more money, shorter hours, and social and intellectual entertainment in the city, and the influence of his early teaching. This last includes parental influence, that of the preacher, and that of the teacher. The farmer often deplores his own business, the preacher until quite recently has confined himself largely to the sphere of morals and religion, and the teacher, as a rule, has very little touch with rural affairs. She has been trained from the town and city point of view, and the books she uses employ not the problems of the farm, but the problems of the city. Suggestions for remedying some of the faults of teaching are pointed out and reasons given for teaching agriculture.

Hints and helps for young gardeners, H. D. HEMENWAY (*Hartford, Conn., 1906, pp. 59, figs. 17, dgm. 1*).—A guide for school and home gardeners intended for those who are young either in years or in experience.

Following an introductory chapter in which the value and influence of gardening are discussed, chapters on the following subjects are given: How to plan the garden, soil tillage, how to test seeds, how to plant, how to dig and set trees, how to make a hotbed and care for the same, strawberry culture, asparagus culture, and window gardening. The chapter on how to plant contains planting tables for vegetables and flowers in which is condensed much valuable information concerning the time, place, and manner of planting; how long it takes each plant to produce flowers and mature seed or to produce edible portions, and in the case of vegetables what part is eaten, how it is prepared for eating, and what the cultivation of each plant teaches.

A course in nature study, F. L. STEVENS and MRS. F. L. STEVENS (*N. C. State Supt. Pub. Instr., Teachers' Bul. 5, pp. 32*).—An outline is given for nature-study work by months, extending through 7 grades of elementary school work. This is followed by suggestions for elaborating the nature-study outline, in which one lesson is treated in considerable detail.

It is recommended that during each month at least one lesson be conducted upon each of the following subjects: Plants, animals, soil, and sky. The object of the work, as stated in the introduction, is not primarily to give information or knowledge, but "to arouse an interest in nature; to put the pupil in a sympathetic attitude toward nature for the purpose of increasing the joy of living."

How to teach the nature-study course, J. DEARNESS (*Toronto: Copp, Clark Co., Ltd. [1905], pp. 206, pls. 5, figs. 41, dgm. 1*).—This is a text-book prepared to aid teachers in presenting that part of the prescribed school courses of Nova Scotia, Ontario, and Manitoba relating to nature study and school gardening. Nature study is first treated in a general way and then taken up with reference to the prescribed courses which are outlined by grades and subject-matter. A list of publications useful for study and reference is given.

Nature study with common things, M. H. CARTER (*New York, Cincinnati, Chicago: American Book Co., 1904, pp. 150, pls. 18*).—This is a laboratory guide of nature study treated from the viewpoint of elementary science. It is intended for pupils in fourth, fifth, or sixth years of city schools.

Studies of 17 common fruits and vegetables are presented, each to be examined in its entirety, in cross section, and in vertical section. There is a sameness of treatment throughout, and, in the author's own words, "many of the observations the pupil is called upon to make in these lessons bear upon no conclusion. They make no attempt to explain anything but are for the sole purpose of being made."

MISCELLANEOUS.

Experiment Station Work, XXXIII (*U. S. Dept. Agr., Farmers' Bul. 244, pp. 32, figs. 6*).—This number contains articles on the following subjects: Handling seed corn; adaptation of seed corn; effect of root nodules on composition of crops; fumigation of nursery stock; cooking quality of potatoes; food value of cottage cheese, rice, peas, and bacon; methods of feeding poultry; extermination of cattle ticks; and covered yards for cows.

The sanitation of a country house, H. B. BASHORE (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1905, pp. VI+103; rev. in Nature [London], 73 (1906), No. 1897, p. 437*).—A short nontechnical treatise on the sanitation of the American country home.

Farm hygiene, P. REGNARD and P. PORTIER (*Hygiène de la Ferme. Paris: J. B. Baillière & Son, 1906, pp. 477, figs. 168; rev. in Mois Sci., 8 (1906), No. 3, p. 7*).—One of the volumes of Encyclopédie agricole published by G. Wery.

Accessions to the Department Library, 1905 (*U. S. Dept. Agr., Library Bul. 58, pp. 64*).

NOTES.

Connecticut Storrs Station.—C. D. Jarvis, a graduate of the Ontario Agricultural College and of the University of Toronto, who has been pursuing advanced work at Cornell University, has been appointed assistant horticulturist to the station, and entered upon his duties early in June. H. D. Edmond, instructor in chemistry and physics in the college, has been appointed station chemist.

Hawaii Station.—A proclamation has been issued setting aside lands at Hamakua, Hawaii, for a tobacco farm. Experiments to cover three years are planned, which will be carried out under the direction of the Federal station. The funds for carrying on the farm are to be supplied by private parties.

Louisiana Stations.—Clifford Waldron, farm manager at the sugar station at Audubon Park, has resigned to accept a position in connection with an extensive sugar establishment in Antigua. He will be succeeded by A. E. Dodson. Dr. G. D. Harris, of Cornell University, has been elected to the chair of geology in the State University, and will divide his time between university duties and the direction of the geological survey of Louisiana.

Maine University and Station.—The "Maine Farming Special," run under the auspices of the college of agriculture and the experiment station over the Bangor and Aroostook Railroad, proved a great success. Thirty-one stops of two hours each were made, and eleven evening exhibitions were given. More than 20,000 people visited the train and listened to the addresses. A similar trip was run over the Maine Central Railroad in June.

The university is giving increasing attention to agricultural extension, and A. W. Gilbert, a graduate of the Massachusetts Agricultural College and of Cornell University, has been placed in charge of this work. Reading and correspondence courses on sixteen different topics are now offered. Efforts are being made to introduce instruction in agriculture and forestry into all of the normal schools of the State. It is now taught in the normal schools at Castine and Gorham, and it is planned to start the work in a small way next year at Fort Kent, Presque Isle, and Farmington. Small tree nurseries will be started at each of the normal schools. The university will offer at its summer school, July 2 to August 3, a course in nature study for teachers.

W. M. Munson has been relieved of his duties as professor of horticulture in the university, and will devote his whole time to experiment-station work. His title in the station has been changed to orchardist instead of horticulturist. L. H. Merrill, professor of biological chemistry, will hereafter give his entire time to the station as chemist. A. C. Whittier, assistant chemist at the Massachusetts station, has been appointed assistant chemist to the station, and Miss Joanna C. Colcord assistant chemist, in place of I. Nurenburg, resigned. Roydon Hammond succeeds Bessie G. Tower as seed analyst and photographer.

New Jersey College and Stations.—The legislature has appropriated $24,000 for the establishment of short courses in agriculture, and $6,500 for the maintenance of the same. The college also received $27,000 due on scholarships for 1902-1905, and $12,000 on scholarships for the present year. The station was given an appropriation of $500 for the inspection of Paris green, and $13,500 for work on the extermination of mosquitoes.

Cornell University.—The traveling summer school of agriculture has been postponed, the requisite number of students not having complied with the requirements.

North Carolina College and Station.—C. W. Burkett has resigned his position as professor of agriculture in the college and agriculturist in the station, and will have charge of short agricultural courses at Ohio State University.

C. B. Williams, who has been connected for a number of years with field-crop work of the test farms under the State department of agriculture, has been added to the station staff. Provision has been made for an additional worker in plant breeding and forage crops, for a tobacco specialist, and an assistant in plant diseases who will give his entire time to the investigation of this subject.

Franklin Sherman, jr., formerly entomologist in the State department of agriculture and the experiment station, who has been connected with the Ontario Agricultural College during the past year, has returned, and R. S. Woglum, who has been acting entomologist in his absence, will be retained as his assistant. R. H. Harper and O. L. Bagley, assistant chemists, have resigned, to take effect September 1, and W. A. Syme, a former graduate of the college, has been appointed in this position.

Ohio Station.—Because of the increasing administrative work of the station, the office of assistant director has been established, and L. H. Goddard, experimentalist, has been appointed to that position. W. F. Pate, formerly assistant chemist in the University of Illinois, and L. L. La Shell have been appointed assistant chemists, and C. H. Kyle assistant agronomist.

Oklahoma Station.—John Fields has resigned the directorship of the station, to take effect October 1. This step has been in contemplation for several months, and is to enable him to give attention to private interests.

Oregon College and Station.—Mrs. Clara H. Waldo, of Macleay, has succeeded William E. Yates as a member of the board, and Austin T. Buxton, of Hillsboro, has succeeded B. G. Leedy. C. I. Lewis has been appointed horticulturist in the station.

South Dakota Station.—Frank A. Norton, assistant chemist, has resigned and has become associated with a laboratory for canning at Aspinwall, Pa.

Utah College and Station.—Funds have been set aside for the completion of the unfinished wing of the cattle barns and for the erection of an additional greenhouse. R. W. Clark, professor of animal husbandry, has resigned to accept a position with the Montana College and Station, and J. T. Caine, a graduate of the college, has been appointed in his place. J. W. Bolte, poultry manager, has accepted a position at the Rhode Island Station. J. A. Crockett, instructor in dairying, has also resigned to engage in private business. E. D. Ball, entomologist, has been granted leave of absence for one year to pursue his studies.

Vermont University and Station.—The corner stone of Morrill Hall, the new agricultural building, was laid June 26. W. J. Morse, assistant professor of botany, has been appointed vegetable pathologist to the Maine Station and will enter upon his duties July 1.

Virginia College and Station.—D. O. Nourse, agronomist, retired at the close of the present college year, after many years of service, to engage in private business.

Washington College.—A four-year course in veterinary science has been established, leading to a bachelor's degree.

Wisconsin University and Station.—James Milward has been appointed assistant in horticulture, to take effect July 1. Leslie H. Adams, for many years farm superintendent at the college and station, has severed his connection with the institution.

According to a note in *Science*, plans for an agronomy building and an agricultural engineering building have been completed, and contracts for their erection are now being made. These contracts will provide for their completion before the beginning of the short course in agriculture next winter.

Wyoming Station.—R. E. Hyslop, a graduate of the University of Wisconsin and a postgraduate of the University of Missouri, has been appointed agronomist and will begin work July 1.

Hampton Normal and Agricultural Institute.—The Shellbanks Farm, which has hitherto been conducted almost entirely on a commercial basis, has recently been turned over to the agricultural department under the direction of Prof. E. C. Bishop, and will henceforth be utilized largely for the instruction of agricultural students. A special three-year course has been inaugurated for those who wish to take agriculture as their main work, and each boy who undertakes the course will put in seven hours of every school day in actual field work under the direction of an instructor, and will also receive two hours of theoretical agriculture and occasionally some night work.

Policy of the Carnegie Foundation.—The trustees of the Carnegie Foundation for the Advancement of Teaching have announced the policy of the foundation, through an article by Henry S. Pritchett in *Educational Review* for June, 1906. The question as to the admission of State institutions to the benefits of the foundation has been left to be decided at the annual meeting of the trustees in November next.

In this connection it is recognized that "from the standpoint of education there are serious objections to the recognition in a State like Wisconsin, for example, of a modest college and the omission of the great State university, which is the real center of high education. On the other hand, an important question of general public policy is involved when a private agency steps in between the State and an institution which the State has founded and controls. For nearly a half century the great State universities in the Central West have labored to establish the principle that higher education in their respective States is to be maintained by the State itself. This principle has been established, and these universities are soon to be in possession of the largest incomes which any institutions in America receive. The State may, therefore, fairly be expected to provide a retiring-pension system for its own professors."

The decision of this matter will be awaited with much interest, as it will affect a large proportion of the workers connected with the agricultural colleges and experiment stations of the country.

The International Agricultural Institute.—A recent number of *Revue Scientifique* states that in spite of pessimistic predictions the future of this Institute is assured, since the following countries have signified their intention to cooperate in its establishment: Italy, France, England, Russia, Germany, Austria-Hungary, United States, Japan, Belgium, Holland, Switzerland, Spain, Portugal, Denmark, Sweden, Greece, Luxemburg, Servia, Bulgaria, Egypt, Persia, Mexico, Equador, Uruguay, Nicaragua, Cuba, and San Salvador, and other powers have signified their intention of cooperating. It is expected that, in accordance with the wish of King Victor-Emmanuel, the new palace in Rome will be completed in 1907, and the following year the work of the Institute will commence.

Agriculture at Cambridge University.—The board of agricultural studies reports that the Worshipful Company of Drapers, to whom it is already indebted for the endowment of the chair of agriculture, has offered \$25,000 toward the buildings required by the agricultural department, on condition that an equal sum be raised by the end of the year. Pledges of \$5,000 each have already been received from four persons.

Agricultural High School of Berlin.—A chair of fishery and fish breeding has been established at the Agricultural High School of Berlin and will be occupied by Dr. P. Schiemenz, director of the Müggelsee Biological Station, which now becomes a department of the Agricultural High School.

Agricultural Continuation School in Germany.—The first agricultural continuation school in the Province of Brandenburg was opened at Jessern last November and continued until the end of March. Fourteen students were in attendance, and the high grades which they maintained in the examinations at the close of the term indicated that the experiment was entirely successful. The subjects taught were

chemistry, soils, fertilizers, and feeding. It is planned to supplement the winter courses by Sunday afternoon lectures during the summer months, and to keep some oversight of the students in their practical work at home. The school was opened at the request of sons of property owners in Jessern and Goyatz, who also bore the cost of instruction.

School of Agriculture, Cedara, Natal.—The Cedara School of Agriculture, which was opened to students in the spring of 1906, provides a 2-year practical course in which students spend about 4 days a week in practical work in the field and workshop, and the remainder of the time in the study of such subjects as forestry, horticulture, dairying, veterinary science, entomology, agricultural chemistry, mathematics, bookkeeping, and surveying. The school is provided with a new building containing 2 stories and a basement, the latter devoted to laboratories, kitchen, etc., the first floor to dining hall, library, and offices, and the second floor to dormitories and a large lecture hall.

Children's Corn and Cotton Contest in Georgia.—The Georgia State College of Agriculture and Mechanic Arts has arranged for children's contests in growing corn and cotton during the summer of 1906. These contests are open to schools or to pupils growing corn or cotton at home. County exhibits of the crops grown will be held during the month of October prior to the State Fair, and the contestants winning prizes in the county contests will be allowed to send their exhibits to the State Fair to enter competition for State prizes.

Irish Training School of Domestic Economy.—The Department of Agriculture and Technical Instruction for Ireland announces that in July, 1906, it will award 10 open scholarships and 10 limited scholarships to assist domestic economy students at the Irish Training School of Domestic Economy, Dublin. These scholarships will entitle the holders to free admission to the full course of training for teachers of subjects in domestic economy. Arrangements have also been made by the Department for the reception of a small number of students at St. Mary's Convent of Mercy, Portumna, to pursue studies in dairying, poultry keeping, horticulture, household management, cookery, laundering, etc.

Monthly Weather Review.—The editor of the *Review*, Prof. Cleveland Abbe, U. S. Weather Bureau, invites librarians of agricultural institutions to inform him promptly as to what numbers or volumes of the *Review* are needed to complete their sets of this periodical. He will be glad to supply the necessary numbers and volumes as far as possible.

Miscellaneous.—A bill appropriating $80,000 to St. Lawrence University for the establishment of an agricultural course and $12,000 for maintenance has been passed by the New York legislature and signed by the governor.

According to *Mark Lane Express*, the establishment of an agricultural college for Devon (England) is being considered under the Seale Hayne bequest.

Hon. W. T. Harris, commissioner of education, has resigned, and Dr. E. E. Brown, professor of the theory and practice of education in the University of California, has been appointed his successor.

Director M. A. Scovell, of Kentucky received the degree of doctor of philosophy from the University of Illinois at commencement.

Dr. W. C. Sturgis, formerly botanist at the Connecticut State Station, has been appointed dean of the new school of forestry, established in connection with Colorado College, to which reference has previously been made (E. S. R., 17, p. 722).

H. D. Hemenway, for a number of years director of the School of Horticulture, Hartford, Conn., has severed his connection with that institution and during the summer will conduct a course in nature study for teachers in the Woodland Farm Camp School, at Westchester, Conn.

EXPERIMENT STATION RECORD.

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The friends of agriculture will learn with sincere regret of the death of Hon. H. C. Adams, of Wisconsin, which occurred at Chicago, July 9, 1906.

Mr. Adams had shown himself to be a most earnest and intelligent friend of agricultural progress, whose varied interests had for many years received his active cooperation and support. As a member of the committee on agriculture of the House of Representatives, he brought to his work wide familiarity with the conditions and needs of agriculture, and judgment as to the means of accomplishing the desired ends, which made him an extremely useful man to the country at large. He was liberal and broad-minded in his conceptions, and active and aggressive in urging what he conceived to be for the common good. Although he took a prominent part in all matters relating to agriculture during his period of service in Congress, his success in securing the passage of the act for the further endowment of agricultural experiment stations stands out as a conspicuous feature of his public career, and has made him a National figure. This act placed him among the great benefactors of agriculture, along with Morrill and Hatch, and will serve as an enduring monument to his memory.

Mr. Adams' avowed intention when elected to Congress was to secure an increase of the appropriation for agricultural experiment stations. In this effort he showed not only an intelligent appreciation of the stations' work, but of the higher work in agricultural science, which must needs be quite limited under existing appropriations. Although not a student of science, he had become thoroughly imbued with the important relations of science in the development of agriculture, and he entertained high ideals for work on the frontiers of agricultural science.

The successful passage of the act which bears his name, after several years of labor in its behalf, was a matter of great satisfaction to him, and he took a keen interest in the preparations for its use. He was called just as the stations were coming into the realization of its benefits and before work under it had fairly been instituted. In the death of Mr. Adams the Federal Department of Agriculture, the experiment stations, and agricultural progress as a whole lose a strong and efficient advocate and supporter.

The appropriation for the U. S. Department of Agriculture for the fiscal year 1907 nearly reaches the ten million mark. The regular appropriation amounts to $9,560,440, and to this is added emergency appropriations aggregating $372,500. The grand total, $9,932,940, represents an increase of $3,050,250 over last year.

A large proportion of this increase is, of course, due to the funds provided for carrying into effect the new meat inspection law, but apart from this the appropriation is larger than last year by over $900,000. Most of the changes came independently of the Department and as the result of popular demand, the emergency appropriations and a considerable number of other items being urged by outside interests. As a matter of fact, the total appropriation, excluding the increased amount for meat inspection, exceeds the estimates of the Secretary of Agriculture by $156,730.

The act embodies an unusual number of new features, several of which are of interest as inaugurating new policies. It marks a growth of confidence in agricultural work and in the Department, and voices an increasing sentiment for Governmental supervision of certain large undertakings, administrative and otherwise, which affect the whole country and are not at present provided for by local agencies.

The Bureau of Animal Industry now leads all other branches of the Department in the amount of its appropriations—$3,946,980. This figure does not include an emergency appropriation of $82,500 for experimental work looking to the eradication of Texas fever ticks, which is to be carried on in cooperation with State authorities. The chief interest in the appropriation for this bureau naturally centers around the new meat inspection law, concerning which there has been so much discussion in the public press. The execution of this law will call for material expansion of the bureau's work in this direction. For this the new law makes a permanent annual appropriation of $3,000,000. Although no specific amount has been mentioned for meat inspection in previous appropriations, about $850,000 a year has been expended, so that the net increase for this purpose is about $2,150,000.

Among other new duties the Bureau is authorized to make tests of tuberculin serums, antitoxins, etc., of domestic and foreign manufac-

ture, which are sold in the United States for the detection, prevention, treatment, or curing of diseases of domestic animals; and is also given $5,000 to conduct experiments in the diseases prevalent among domestic animals in Minnesota and adjoining States, in cooperation with the Minnesota Experiment Station, with a view to developing antitoxin or preventive vaccines. Twenty thousand dollars is specially designated for "further developing the dairy industry of the Southern States, by conducting experiments, holding institutes and giving object lessons, in cooperation with individual dairymen and State experiment stations."

The amount appropriated for the Weather Bureau is $1,439,240, an increase of $46,250. The work provided for does not involve any particularly new features.

The largest increase, except in the case of the Bureau of Animal Industry, is for the Bureau of Plant Industry, $142,860, making the total $919,740. To this should be added an emergency appropriation of $105,000 for continuing work against the cotton-boll weevil by encouraging the diversification of crops and improved cultural methods, breeding new cotton, etc. Some of the new features provided for in this Bureau are the provision for inspection of grain at certain points of export, for which $15,000 is named, a special investigation of parasites and orchard diseases prevalent in the Ozark Mountain region, with a special appropriation of $5,000, the erection of a laboratory and office building at the plant introduction garden at Chico, California, and $3,500 for the improvement and macadamizing of gravel roadways in the Department grounds. The provision for the purchase of seeds for Congressional distribution, which was eliminated by the House of Representatives but was restored in the Senate Committee on Agriculture, remains $242,920, of which as formerly $37,780 is for the introduction of seeds and plants from foreign countries.

The Forest Service is given a round million, which is an increase of $124,860 over last year. Under the emergency appropriations $15,000 is provided for the erection of a wire fence on the Wichita Forest and Game Preserve, to provide a range for the buffalo herd presented by the New York Zoological Society; and $2,500 for a building on Dismal River Forest Reserve in Nebraska. A new and important feature affecting the policy of the Government with reference to the forest reserves is incorporated in the act. This authorizes the payment each year of 10 per cent of the money received from these reserves to the State or Territory in which the reserves are respectively located, to be expended by the legislature for the benefit of the public schools and public roads of the county or counties in which the reserves are situated. This provision is looked upon with much favor, as it will in large measure offset the loss to the counties due to the withdrawal of land from settlement and ultimate taxation.

Under the present method of administering the forest reserves they

have become a considerable source of revenue. During the past fiscal year the proceeds from these reserves amounted to $767,219.96. Of this amount $203,443.27 was derived from sales of timber, $39,224.96 from "trespass," on account of timber previously cut but not paid for, and $514,086.74 for grazing. It is confidently expected that in a few years these reserves will not only be self-sustaining but will return a considerable revenue over their cost of management.

The total for the Office of Experiment Stations, including the $720,000 for the State experiment stations under the Hatch Act, is $974,860. The general maintenance fund of the Office is increased to $25,500, aside from the statutory salaries. The special appropriation of $3,000 for Alaska, for the purchase and introduction of live stock for experimental purposes, is continued, and the Hawaii Station is given $5,000 additional to provide a suitable water supply. There is an increase of $48,000 for irrigation and drainage investigations, making the total for that purpose $122,200, and the field of the Office is broadened to include agricultural education, the act authorizing the promotion of elementary education in agricultural schools.

The total appropriation for the Office, aside from the amount carried for the State stations, is $254,860, an increase of $56,960 over last year. A clause in the act authorizes the Secretary of Agriculture to turn over to the Georgia Station the buildings and machinery at Waycross, Ga., which were used by the Department in the study of the production of table sirup, the condition being that the Georgia Station shall establish and maintain a substation at Waycross in the interest of the sirup and other agricultural industries in that part of the State.

In reality the act authorized the expenditure of $240,000 which does not appear in any of the totals. This was on account of the Adams Act, increasing the Federal appropriation for the State experiment stations. Under the opinion of the Comptroller, this act would not have gone into effect until the fiscal year 1907, but it was construed by the agricultural bill to appropriate $5,000 to each State for the fiscal year ending June 30, 1906, and following this construction the Treasury Department made these advances as soon as possible after the passage of the agricultural bill. This amounted to $240,000 in all, a part of which will doubtless remain unexpended, owing to the late date in the fiscal year on which the bill passed. A considerable proportion of the stations, however, were enabled to secure necessary permanent equipment and the like for investigation to be undertaken with the new act, and the work will thus be started on a larger and more effective scale than would otherwise be possible, especially as the amount for the present year is increased to $7,000.

For the Bureau of Chemistry the appropriation is $174,180, an increase of $19,180 over last year. The Bureau of Entomology receives $94,610, an increase of $10,140, of which $5,000 is for investi-

gating the white fly affecting the orange groves of Florida. It also has an emergency appropriation of $85,000 for its cotton-boll weevil investigation, and of $82,500 for establishing a quarantine against the further spread of the gypsy and brown-tail moths in New England, in cooperation with the authorities in the different States concerned. The fund for the Bureau of Soils is increased $16,800, making the total for this year $221,460; that for the Bureau of Statistics amounts to $210,560; and for the Biological Survey $52,000, the same as last year.

The Office of Public Roads receives $70,000, an increase of $20,000, and the Division of Publications $248,520, including, as usual, $98,750 for the preparation and printing of Farmers' Bulletins. Other items are: Office of the Secretary, $113,200; Library, $25,880, an increase of nearly $5,000; Division of Accounts and Disbursements $32,210, and contingent expenses, $37,000.

The new allotment to the Department from the printing fund is $300,000 instead of $185,000 as formerly. This increase is apparent rather than real, as the $115,000 added is intended to compensate for certain changes in the printing law which place a large share of the expenses for the Yearbook, annual reports, and the like upon the Department. This fund, together with the proceeds from the forest reserves, which are available for the use of the Forest Service and are to be taken into account in future estimates, makes the total income of the Department for the fiscal year 1907 over eleven million dollars.

The growth of the Department in police or inspection duties is one of the most salient features of the development of the past year. The largest of these undertakings at present is the inspection of meats and packing houses. The agitation for more thorough control of the packing industry, with representations as to the inadequacy of the laws in force and the insufficiency of the appropriations for carrying them into effect, resulted in the passage of a law which is said by experts to be the broadest and most stringent of its kind in force in any country. Rarely has the weight of public sentiment been more forcibly felt in legislation than in the case of this law.

The law provides for ante-mortem and post-mortem examination of animals intended for meat, and of the products at various stages, all parts found to be "unsound, unhealthy, unwholesome and otherwise unfit for human food" to be destroyed for food purposes in the presence of an inspector. The inspection is extended to canned and otherwise prepared meats, which are required to bear the label showing that they have been inspected and passed, the same as in the case of fresh meat. The law directs that all products shall be condemned which contain dyes, chemicals, preservatives, or ingredients injurious to health, except when packed for export to a foreign country with whose laws such treatment does not conflict.

An important provision is that for a sanitary inspection of the packing establishments themselves, authorizing the Department to prescribe the rules and regulations of sanitation under which they shall be maintained, and to withhold the inspection label from the products of establishments which do not meet these requirements. The inspection label is a requisite to shipment of meat or meat products from one State to another, or to a foreign country, so that transportation companies are made subject to the law; and the inspection also extends to live cattle, sheep, swine, and goats intended for export. Penalties for violating the provisions of the law are fixed at a fine not exceeding $10,000 or imprisonment for not more than two years, or both. Heavy penalties are also provided for bribery of inspection officials, or the acceptance of a bribe. Farmers and retail butchers are exempted from the requirements of inspection.

Another important line of inspection work inaugurated by the last Congress is that in connection with the execution of the National pure food law. This law prohibits interstate commerce in foods which have been adulterated or misbranded, or which are unwholesome or contain preservatives or other additions making them injurious to health; and it also prohibits the manufacture or sale of such products in any Territory, the District of Columbia, or our insular possessions. It covers foods, condiments, beverages of all sorts, drugs, and medicines. Heavy penalties of fine or imprisonment, or both, are imposed for violations of the law, and condemned goods in process of transportation from one State to another, or to a foreign country, may be confiscated.

The Department of Agriculture is charged with the administration of the law, with the collaboration of the Treasury Department and the Department of Commerce and Labor. The burden of maintaining the inspection of food products under this law and of determining what constitutes adulteration, will fall upon the Bureau of Chemistry of this Department. No funds have yet been appropriated by Congress for carrying the law into effect, but considerable time will be required for drawing up regulations and making the necessary preliminary arrangements. Congress will be asked to make an immediately available appropriation when it convenes in December next. It is the expectation of the friends of the measure that it will very materially strengthen and supplement the efforts of the several States in stamping out the various forms of sophistication which have become so prevalent.

An important branch of inspection work for which only a beginning is provided by the appropriation act is the grain inspection. There was considerable agitation of this subject at the recent session of Congress, the contention being that provision should be made for an inspection by the Department of Agriculture of grain for export to

foreign countries, this inspection being for quality, condition, and grade, and to serve as the basis for an official certificate. The bulk of grain is now sold on the certificate of inspectors employed by boards of trade and similar agencies, and there is frequently a lack of uniformity in these certificates for similar lots. Questions arise as to the accuracy of the certificate and the condition and deterioration in transit, out of which dissatisfaction has grown which has affected our foreign trade.

The result of consideration of this matter was that the Secretary of Agriculture was authorized "to establish at such points of export as he may deem expedient, laboratories for the purpose of examining and reporting upon the nature, quality, and condition of any sample, parcel, or consignment of seed or grain." The amount named for this purpose was $15,000, which will obviously provide only quite limited facilities for such inspection, but will afford a court of appeal in doubtful or disputed cases. This is doubtless one of the features which will grow in extent as its importance and usefulness are realized, and may ultimately assume considerable proportions.

It will thus be apparent that the Department is adding to its administrative and investigational functions extensive and important inspection work, which is broadened to include not only the special interests of the farmers but the people as a whole.

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RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

Introduction to the investigation of products important in agriculture, C. Böhmer (*Anleitung zur Untersuchung landwirtschaftlich wichtiger Stoffe. Berlin: Paul Parey, 1906, pp. VIII+135*).—This book is intended as a guide for students and teachers in agricultural-chemical laboratories.

The methods described are in the main those approved by the International Congress of Applied Chemistry and of the Association of German Agricultural Experiment Stations. The topics treated are mechanical analysis of soils; examination of commercial fertilizers, including methods of determining phosphoric acid, nitrogen, potash, and lime; examination of feeding stuffs; determination of the sugar content of beets; milk examination; chemical analysis of soils, including preparation of hydrochloric-acid solutions and their examination, fusion with alkaline carbonates and reduction by means of hydrofluoric-acid, and the determination of nitrogen; and preparation of solutions used in analysis.

Equilibrium between some bases when they are present simultaneously with phosphoric acid, A. Quartaroli (*Gaz. Chim. Ital., 35 (1905), II, pp. 290–304; Staz. Sper. Agr. Ital., 38 (1905), No. 7–8, pp. 639–657; abs. in Jour. Soc. Chem. Indus., 24 (1905), No. 23, p. 1229*).—The author reports studies of the conditions of equilibrium in the following systems: (1) $1H_3PO_4 + \frac{1}{2}CaO$ (or BaO) $+ 2KOH$ (or $NaOH$); (2) $1H_3PO_4 + \frac{1}{2}CaO$ (or BaO) $+ 1NaOH$; (3) $1H_3PO_4 + \frac{1}{2}MgO + 2NaOH$ (or KOH); (4) $1H_3PO_4 + \frac{1}{2}MgO + 1NaOH$ (or KOH).

In the experiments which are reported 25 cc. of a normal solution of phosphoric acid was mixed with corresponding amounts of the alkaline solutions and the whole made up to 500 cc. An aliquot of the solution was filtered immediately and the filtrate titrated with twice-normal hydrochloric acid in presence of methyl orange and phenolphthalein. After standing for 2 days another portion of the solution was filtered and titrated in the same way.

"In system (1) barely one-third of the phosphoric acid present is precipitated, in the form of tri- and tetrabasic salts, and not two-thirds in the form of a double salt $Ca_3(Ba_3)Na_6(PO_4)_4$, as Berthelot stated. Two-thirds of the phosphoric acid remains in solution in the form of tri- and di-basic salts. The bases are distributed irregularly between the precipitate and the solution. If the system $1H_3PO_4 + \frac{1}{2}BaO + 2NaOH$ be allowed to stand for a long time, the precipitate ultimately contains one atomic proportion each of sodium and barium, and nearly one-half of the acid is precipitated. In system (2) also, the bases are distributed irregularly between the precipitate and the solution. The latter contains mono- and dibasic phosphates, whilst the precipitate contains di-, tri-, and, occasionally, tetrabasic salts. Less than two-thirds of the phosphoric acid is precipitated.

"Magnesia behaves differently from lime and baryta, and its behavior depends also on the kind of alkali present. For example, in system (3) when the alkali employed is sodium hydroxid, the precipitate consists solely of magnesium compounds, whilst when potassium hydroxid is used, some alkali is carried down by the precipitate. In system (4) much less phosphoric acid is precipitated (only about

one-sixth of the total quantity); apparently a soluble double phosphate is formed, as dimagnesium phosphate is insoluble, and the amount of alkali present would be sufficient for the precipitation of the remaining dissolved magnesium under ordinary conditions."

The reactions of the three phosphoric acids, C. ARNOLD and G. WERNER (*Chem. Ztg., 29 (1905), No. 104, pp. 1326, 1327; Analyst, 31 (1906), No. 360, pp. 92, 93*).—The authors' tests of published reactions having shown them to be generally unreliable, a new series of tests with the alkali salts of ortho-, pyro-, and metaphosphoric acids is given.

On the compounds of pyrophosphoric acid, J. CAVALIER (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 15, pp. 885–887*).—Four series of salts of this acid, which is taken to be tetrabasic ($P_2O_7H_4$), are briefly described. Studies of the vapor densities of a series of alcoholic pyrophosphates show that they have a molecular weight corresponding closely with the formula $P_2O_7R_4$.

On the determination of citric-acid soluble phosphoric acid in Thomas slag, II. FRESENIUS (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 12–15*).—A brief review is given of studies of this method.

The determination of phosphoric acid in fertilizers as phosphomolybdic anhydrid, G. BERJU (*Jour. Landw., 54 (1906), No. 1, pp. 31–46; abs. in Chem. Ztg., 30 (1906), No. 24, Repert. No. 7, p. 94*).—This article reports a study of the accuracy of Neumann's method[a] as applied to pure phosphates and Thomas slag solutions prepared in various ways. The method is reported to have given accurate results under all conditions and is much simpler and more accurate than direct precipitation of phosphoric acid as magnesium-ammonium phosphate.

The determination of ammoniacal nitrogen in ammoniated superphosphates, SCHEELE and VON SOXHLET (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 15–17*).—A brief account is here given of the discussion of methods for this purpose at the Munich meeting of the Association of German Agricultural Experiment Stations.

A simple method for the determination of nitric acid in nitrates, J. T. BORNWATER (*Chem. Weekbl., 3 (1906), pp. 30, 31; abs. in Chem. Centbl., 1906, I, No. 8, p. 703*).—In the method proposed the nitrate is reduced by means of potash solution and aluminium foil and the ammonia distilled in a Kjeldahl apparatus.

On the need of uniform methods of titration in the determination of nitrogen, B. SCHULZE (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 35, 36*).—A brief account of the discussion of this subject at the Munich meeting of the Association of German Agricultural Experiment Stations, calling attention to lack of uniformity in kind and strength of acids and alkalis used and of the desirability of greater uniformity in these respects.

The determination of potash by means of perchloric acid (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 6, 7*).—This method is described and its unanimous adoption by the Association of German Agricultural Experiment Stations is recorded.

The detection and determination of chlorate in sodium nitrate, L. GRIMBERT (*Jour. Pharm. et Chim., 6. ser., 23 (1906), pp. 98–100; abs. in Analyst, 31 (1906), No. 361, p. 128*).—Sodium nitrate is tested for presence of chlorate by shaking up the solution with 1 drop of anilin, and pouring a little strong sulphuric acid down the side of the tube. If chlorate is present an intense blue zone appears at the junction of the liquids. Chlorate is determined quantitatively by igniting the nitrate with a little cane sugar, extracting with water, and titrating for chlorids in the usual way.

On the gravimetric determination of calcium, O. BRUNCK (*Ztschr. Analyt. Chem., 45 (1906), No. 2, pp. 77–87, fig. 1*).—Comparisons of various methods—direct weighing, weighing as carbonate, sulphate, and fluorid—of determining lime are reported. Direct weighing gave the most unsatisfactory result—generally too high.

[a] Ztschr. Analyt. Chem., 37 (1898), p. 317.

The other three methods gave closely agreeing results and were about equally satisfactory. The fluorid method is probably the quickest and most satisfactory in the hands of beginners. For control purposes it is recommended to weigh first as carbonate and then convert into sulphate or fluorid.

Determination of lime in soils, D. J. Hissink (*Chem. Weekbl., 3 (1906), pp. 73–78; abs. in Chem. Centbl., 1906, I, No. 11, p. 961*).—Neubauer's method is recommended.

The analysis of foods. Simple and easy methods of detecting adulteration of food products and other domestic articles, C. Margeot (*L'analyse des aliments. Recettes simples et faciles pour découvrir toutes les falsifications des produits alimentaires et autres objets domestiques. Paris: E. Flammarion, pp. 188*).—As the subtitle states, this volume gives simple directions for the detection of adulteration of food products and other materials used in the home. The descriptive matter includes standards of quality of staple articles of food, the principal methods of adulteration and sophistication which are likely to occur, and methods of detection of adulteration.

The use of the immersion refractometer in food analysis, J. Hanuš and K. Chocenský (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, pp. 313–320, fig. 1*).—The experimental data described show that the immersion refractometer may be used to determine the amount of caffein present in aqueous solution quickly and accurately.

Maple sirup and maple sugar investigations with particular reference to the detection of adulteration, C. H. Jones (*Vermont Sta. Rpt. 1905, pp. 315–339*).—A number of samples of maple sugar and sirup, maple cream, and brown sugars were examined with special reference to the amount and character of the ash present, the malic acid value, the amount of precipitate obtained with lead subacetate, and other characteristics, the object of the investigations as a whole being the detection of adulteration, particularly with cane and beet sugar products.

According to the author, the minimum standards which seem warranted when applied to a filtered sirup weighing 11 lbs. to the gallon are not less than 0.50 per cent total ash, not less than 0.15 per cent insoluble ash, not less than 0.40 per cent malic acid value, nor less than 1.00 cc. for the lead subacetate precipitate.

If an examination of an original sample shows that one or all of such salient factors are below the minimum, the samples should be boiled to a uniform basis of concentration and filtered. It would seem, the author states in effect, that a certain minimum amount of ash can not be removed from pure maple sirup or maple sugar made into sirup, by the ordinary methods of filtration, and that even slow and complete filtering fails to remove sufficient ash from the pure goods to admit even a suspicion of adulteration.

The ash of pure maple goods consists largely of carbonates of potassium and lime with relatively small and varying quantities of sulphates and phosphates. The determination of the sulphates, according to the author, is of use at times in detecting adulteration since they are present in relatively large amounts in many commercial brown, cane, and beet sugars.

"The amounts of lime and potash also afford data useful in judging the purity of suspected samples. Owing to the work involved these determinations are needful only in important cases when other tests do not furnish convincing data.

"It has been observed that the percentage of sulphates appears to be greater in maple sirup than in maple sugar, although no explanation has been offered. In the writer's opinion, it may be accounted for as follows: The percentage of ash, soluble in water, is greater in sirups than in sugars. . . . This is due entirely to the larger quantity of malate of lime (insoluble ash) in the sugar. As sulphates are found largely in the soluble ash, they would therefore average greater on an ash basis in sirups than in sugars.

"The author has yet to see a pure maple sirup that, even after souring or long keeping under any reasonable conditions, will not furnish an abundant maple aroma on boiling after dilution with water. The flavor or taste of maple goods may serve in a measure to indicate their purity. Inasmuch as many pure maple sirups, particularly those produced in certain sections of the country, have what might be termed a 'molasses taste,' it is best not to form hasty opinions from this sense alone, especially if the origin, age, and conditions of manufacture are not known. The flavor taken into consideration with color is a good criterion as to quality of maple products." (For earlier work see E. S. R., 17, p. 219).

The examination of honey, H. MATTHES and F. MUELLER (*Ber. Nahrmtl. Untersuch. Amt. Jena, 1903–4, pp. 37–45; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 9 (1905), No. 12, pp. 739–741*).—Detailed directions are given for determining the different constituents and constants desirable in an analysis of honey, a feature of the work being the recommendation that a uniform solution of honey be used in every case. The author prepares the solution by dissolving 5 gm. of warm well-mixed honey in 50 gm. of warm water and then diluting to 150 gm. The results of the analyses are all expressed on the dry-matter basis.

Concerning starch, glycogen, and cellulose, Z. H. SKRAUP (*Monatsh. Chem., 26 (1905), No. 11, p. 1415; abs. in Zentbl. Physiol., 20 (1906), No. 1, pp. 1, 2*).—The chlorazetyl products of starch, glycogen, and cellulose were made by treatment with acetic-acid anhydrid saturated with hydrochloric acid.

From the chlorin content of the bodies formed it is possible to secure data regarding molecular weight. The calculated molecu ar weight for soluble starch was 7,440, which implies that the starch formula is 46 to 50 times $C_6H_{10}O_5$. The calculated molecular weight for glycogen was 23,630, which would imply a very complicated molecular structure. The values obtained for cellulose from filter paper indicate that the formula is not higher than for soluble starch, perhaps $(C_6H_{10}O_5)_{34}$.

Chemistry of the albumens, S. B. SCHRYVER (*Philadelphia: P. Blakiston's Son & Co., 1906; rev. in Jour. Amer. Chem. Soc., 28 (1906), No. 5, pp. 658–660*).—The present knowledge of the chemistry of proteids is summarized.

"Facts relating to the solubility, physical properties, precipitation by salts, coagulation, behavior toward acids and bases, etc., which have, in the past, formed so large a part of the accounts that have been written of these bodies occupy in this book but a very insignificant place. This fact shows the great progress made during the past five years in our knowledge of the chemical side of this subject, for it is now possible to give a condensed account of the purely chemical facts that are known which is sufficiently extensive to warrant their publication in a separate volume."

A considerable part of the volume is taken up with the chemistry of the nucleic acids and their decomposition products, especially the purin and pyrimidin bodies, which bear no chemical relation to the protein molecule proper. "The only reason for including the nucleic acids is the fact that they are always found in nature together with the proteins or the protamins. This practice, while convenient for those familiar with the proteins, leads to confusion among those who take only a general interest and read such books as the one under consideration in order to obtain a general knowledge of the chemistry of the proteins."

Crude gluten, F. A. NORTON (*Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 8–25*).—According to the author's investigations "crude gluten consists of about 75 per cent of true gluten—gliadin and glutenin—together with small percentages of nongluten proteid, mineral matter, fat, starch, fiber, and other nonproteid matter.

"The relation of the crude gluten content to that of total protein (N × 5.7) varies with the character of the flour, the crude gluten content being greater than total protein for straight and low-grade flours, nearly the same for patent flours, and less for whole-wheat meal.

"Crude gluten is an expression, in addition to the true gluten content of a flour, of the balance between the loss of nongluten proteids and gain from the retention of nonproteid substances. The relation of the crude gluten content to the total protein content can thus be explained by the varying composition of the different flours in respect to nitrogenous compounds and nonproteids.

"Crude gluten is a very rough expression of the gluten content of a flour or wheat and the determination has but little worth in the valuation of flours.

"The determination of total nitrogen and gliadin nitrogen with expression of the ratio of gliadin to total protein (N × 5.7) seems to be the best simple method at hand for estimating the gluten content and ascertaining the character of the gluten in the valuation of wheats or flours."

Determining the sulphurous acid in meat, C. MENTZEL (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, pp. 320–324*).—In a number of cases the distillation method showed the presence of small amounts of sulphurous acid (5 to 7.8 mg.) in chopped meat when it could not be identified by means of potassium-iodid-starch paper.

The estimation of undigested protein in feces by means of thiosinamin acid, E. ROSENBERG (*Arch. Verdauungskrank., 11, p. 321*).—Oefele's method of estimating undigested protein is, according to the author's investigations, not reliable.

Concerning the composition of lecithin, M. WINTGEN and O. KELLER (*Arch. Pharm., 244 (1906), No. 1, pp. 3–11*).—Studies of the phosphorus and nitrogen content of lecithins of animal and vegetable origin are reported. The purity of lecithin can not be ascertained by determining the nitrogen and the phosphorus content alone. Whether the determination of the iodin value and the free fatty acid value will serve for the purpose must be determined by further investigation.

General and physiological chemistry of fats, F. ULZER and J. KLIMONT (*Allgemeine und physiologische Chemie der Fette. Berlin: J. Springer, 1906; rev. in Österr. Chem. Ztg., 9 (1906), No. 9, p. 128*).—A monograph on the chemistry of fats from the standpoint of theoretical and physiological chemistry. A feature of the work is the data on the qualitative chemical composition of the fats. Chapters on the hydrolytic cleavage of fat from the standpoint of physical chemistry, by E. Abel, and on the cleavage of fat by enzyms, by S. Fokin, are included.

Concerning the estimation of fat in oil-bearing seeds, F. RUPPEL (*Ztschr. Analyt. Chem., 45 (1906), No. 2, pp. 112–114*).—The modified method proposed consists in extracting the bulk of the fat by treating the finely ground seed for 6 hours with ether, then drying the undissolved residue, grinding with quartz sand, and extracting aliquot portions until all fat is removed.

Contribution to the examination of butter, M. SIEGFELD (*Milchw. Zentbl., 2 (1906), No. 4, pp. 145–164, dgms. 5*).—This is a continuation of investigations previously noted (E. S. R., 17, p. 9).

The data obtained in the examination of the butter from 2 dairies for several years are used as the basis for a discussion of the relative value of determinations of the Reichert-Meissl number, Polenske number, saponification number, iodin number, and the average molecular weight of the fatty acids in the examination of butter. In general, an increase in the Reichert-Meissl number was accompanied by an increase in the saponification number and a decrease in the iodin number, and in the average molecular weight of the nonvolatile fatty acids. The sample having the lowest Reichert-Meissl number, 23.7, had a saponification number of 218.7, an iodin number of 47.4, and an average molecular weight of 269.9. The sample having the highest Reichert-Meissl number, 31.65, had a saponification number of 229.9, an iodin number of 34.6, and an average molecular weight of 257.6.

A simple method of determining fat in milk, KÜTTNER and ULRICH (*Ztschr. Öffentl. Chem., 12 (1906), No. 9, pp. 162–166*).—Numerous tests were made of the Sichler method in comparison with other methods, the results being considered as showing that this method is a decided improvement over the rapid methods previously used.

Gerber's salt method, C. BEGER (*Milchw. Zentbl., 2 (1906), No. 3, pp. 120–123*).—The author reports favorably upon the use of this new method of determining fat in milk.

The influence of acetic acid and alcohol in gravimetric determinations of the total solids in milk, A. SEGIN (*Milchw. Zentbl., 2 (1906), No. 3, pp. 115–119*).—The author uses the covers of porcelain crucibles from which the small central handles have been broken off, measuring into each cover about 2.5 cc. of milk, and rapidly weighing the sample. The milk is then evaporated over a water bath and the residue dried to a constant weight in a water oven at 100° C., which requires about 4 hours. No absorbent material is used.

The time required for drying to a constant weight was increased by the addition of acetic acid and alcohol and higher results were usually secured. The direct drying in small porcelain dishes is recommended as one of the most accurate, convenient, and reliable methods for determining solids in milk.

On the watering of wine and milk, L. SURRE (*Ann. Chim. Analyt., 11 (1906), No. 5, pp. 163–165*).—The methods given for the detection of added water depend upon the diphenylamin reaction for nitrates, which is not given by these materials when pure.

Collaborative work on tannin analysis, F. H. SMALL (*Jour. Soc. Chem. Indus., 25 (1906), No. 7, pp. 296–298*).—This is a brief review of the work of several associations on the methods of estimating tannin. A fairly satisfactory method, the principles of which are given, has resulted, according to the author, from this collaborative work. The various lines of work of the American Leather Chemists' Association now in progress are outlined.

Miscellaneous chemical analyses made in 1901, A. M. PETER and L. O. BEATTY (*Kentucky Sta. Rpt. 1901, pp. 263–295*).—Analyses are reported of 49 samples of sorghum juice, 22 of butter, 27 of sugar beets, 17 of soils, 7 of feeding stuffs, 9 of common salt, 4 of crude petroleum, 1 of marl, 2 of phosphate rock, 4 of clay, 4 of ashes, 2 of tobacco stems, 1 of a tobacco by-product, 5 of tobacco extract, 3 of Paris green, 1 of a commercial substance recommended for use in curing tobacco, 5 of Kentucky asphalt rock, 1 of iron ore, and 24 of mineral waters. Determinations were also made of the arsenic in 6 samples of sprayed cabbage.

Miscellaneous chemical analyses made in 1902, A. M. PETER, L. O. BEATTY, and S. D. AVERITT (*Kentucky Sta. Rpt. 1902, pp. 283–335*).—Analyses are reported of 16 samples of sorghum juice, 31 of sugar beets, 10 of butter, 27 of soils, 1 of old wood ashes, 61 of grasses and forage plants, 6 of soy beans, 1 of mushrooms, 2 of cotton-seed meal, 1 of a calf food, 1 of distillers' corn bran, 1 of dried distillers' grains, 5 of distillery slop, 5 of clay, 2 of niter earth, 1 of dissolved bone, 1 of agricultural lime, 1 of cow manure, and 42 of mineral waters.

Miscellaneous analyses, C. H. JONES and F. M. HOLLISTER (*Vermont Sta. Rpt. 1905, pp. 339, 340*).—Analyses of a number of miscellaneous materials, including nitrate of soda, dried blood, tankage, bone (raw and steamed), acid phosphate, muriate of potash, wood ashes, muck, and mixed fertilizers, are reported.

METEOROLOGY—WATER.

Monthly Weather Review (*Mo. Weather Rev., 34 (1906), Nos. 1, pp. 1–60, figs. 19, charts 8; 2, pp. 61–108, figs. 9, charts 28*).—In addition to the usual reports on forecasts, warnings, weather and crop conditions, meteorological tables and charts for the months of January and February, 1906, recent papers bearing on meteorology, recent additions to the Weather Bureau library, etc., these numbers contain the following articles and notes:

No. 1.—The Cyclonic Storm of October 6–12, 1905, in the North Atlantic Ocean (illus.), by J. Page; Improved Methods for Finding Altitude and Azimuth, Geo-

graphical Position, and the Variation of the Compass—Second Article (illus.); Studies on the Thermodynamics of the Atmosphere—I, Asymmetric Cyclones and Anticyclones in Europe and America (illus.), by F. H. Bigelow; Atmospheric Electricity, by G. C. Simpson; Atmospheric Electricity in High Latitudes, by G. C. Simpson; The Time of Moonrise and Moonset (illus.), by W. F. Rigge; A Possible Extension of the Period of Weather Forecasts, by E. B. Garriott (see p. 1045); Forecasts and Verifications in Western Australia, by W. E. Cooke; The Relation of Forests to Rainfall (illus.), by W. F. Hubbard (see p. 1044); An Important Old Local Weather Record for Philadelphia, Pa.; An Appeal for an Aero-physical Observatory in Japan, by S. T. Tamura; Tornadoes—Hailstones—Thunderclouds, by J. P. Gibson; and Weather Bureau Men as Educators.

No. 2.—The Relation between Storm Movement and Pressure Distribution (illus.), by E. H. Bowie; Climatology of Haiti in the Eighteenth Century (illus.), by C. F. Talman; Mean Annual Rain Map of New South Wales; Studies on the Thermodynamics of the Atmosphere—II, Coordination of the Velocity, Temperature, and Pressure in the Cyclones and Anticyclones of Europe and North America (illus.), by F. H. Bigelow; Vertical Air Currents, by F. W. Proctor; Snow Formed by Mixture of Warm and Cold Air, by R. W. Gray; Prevention of Damage by Frost, by R. P. Skinner (see p. 1044); Early Knowledge of the Tides at Panama, by R. A. Harris; Publication of River Gage Readings; Weather Bureau Men as Educators; Life and Work of James P. Espy; Lectures on Meteorology; Hailstorms in the Bahamas; A Fake Rain Maker; and Outline for the Study of Meteorology in the New York State Normal School.

Meteorological observations (*Idaho Sta. Rpt. 1905, pp. 36–48*).—Daily and monthly summaries are given of observations during 1905 on temperature, pressure, precipitation, cloudiness, and wind movement. The mean temperature of the year was 48.6°, the highest temperature 103°, July 22; the lowest −13°, February 11; the total precipitation (rainfall and melted snow) was 20.37 in., the rainfall being 17.51 in.

Meteorological summaries for the year 1901 (*Kentucky Sta. Rpt. 1901, pp. 296–301*).—Tabular summaries for 1901 are given of observations at the station on pressure, temperature, precipitation, cloudiness, wind movement, and casual phenomena.

Meteorological summaries for the year 1902 (*Kentucky Sta. Rpt. 1902, pp. 336–341*).—Tabular summaries for 1902 are given of observations at the station on pressure, temperature, precipitation, cloudiness, wind movement, and casual phenomena.

Meteorological observations (*Maine Sta. Bul. 124, pp. 229–231*).—Monthly and annual summaries are given of observations at the experiment station on pressure, temperature, precipitation, cloudiness, wind movement, and of rainfall at 24 different places in the State. The mean pressure for the year was 29.84 in., the mean temperature 42.13° (normal for 37 years 42.2°), precipitation 32.01 in. (normal for 37 years 43.98 in.), snowfall 70.5 in. (normal for 37 years 91.6 in), number of clear days 150, cloudy days 121.

"The winter of 1904–5 was one of unusual severity, December being 4½°, January 3°, and February 4° below the average for these months. . . . During this same period the thermometer registered zero or below, as the minimum temperature, on no less than 50 days.

"For three successive years the total precipitation has been very low, the deficit for the past year amounting to about 12 in., or over one-fourth of the whole. The shortage was especially noticeable in March and October, in which months the precipitation was about one-fifth the average. In but one month of the year, November, did the precipitation equal the average amount."

Meteorological observations, J. E. OSTRANDER and T. A. BARRY (*Massachusetts Sta. Met. Buls. 207, 208, pp. 4 each*).—Summaries of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during March and April, 1906. The data are briefly discussed in a general note on the weather of each month.

Meteorological observations at the Michigan Agricultural College for the year 1904 (*Michigan Sta. Rpt. 1905, pp. 99–123*).—Tabulated daily and monthly summaries of observations during 1904 on temperature, pressure, precipitation, humidity, cloudiness, wind movement, etc.

Swedish meteorological observations, 1904, H. E. HAMBURG (*Met Iakttag. Sverige* [*Observ. Mét. Suéd.*], *K. Svenska Vetensk. Akad., 46* (*1904*), *pp. X+157*).—This report is divided into 3 parts, (1) daily observations at 18 stations of the second order, (2) monthly and annual summaries of all the meteorological elements furnished by 39 stations of the second order, and (3) 5-day means of temperature at the 39 stations included in part 2.

Meteorological observations for the year 1904 at the Ploti Agricultural Experiment Station, M. SVOLINSKY (*Ghodichnuĭ Otchet Ploty. Selsk. Khoz. Opuitn. Stantziĭ, 10* (*1904*), *pp. 1–25*).—As in previous years (E. S. R., 16, p. 544), this report summarizes observations on precipitation (including snowfall), evaporation, humidity of the air, temperature of the air and of the soil at different depths, insolation and solar radiation, atmospheric pressure, and direction of wind. The total precipitation during the year was 299.4 mm., the smallest for the ten years during which observations have been made at the station. The distribution of the rainfall, however, was favorable for the growth of crops. The mean annual temperature of the air was below normal. The maximum temperature was 35 1° C., July 18; the minimum, —23.2°, January 11 and 13. The maximum pressure during the year was 764.6 mm., the minimum 728 mm. The prevailing direction of wind was northwest.

Observations at the meteorological observatory of the University of Innsbruck in 1902, W. TRABERT (*Ber. Naturw. Med. Ver. Innsbruck, 29* (*1903–4, 1904–5*), *pp. 277–337*).—Detailed tabular records of daily observations on atmospheric pressure, temperature, humidity, cloudiness, wind, and precipitation, and hourly observations with self-recording apparatus on pressure, temperature, humidity, rainfall, and sunshine are given for each month of the year.

International Meteorological Conference at Innsbruck (*Nature* [*London*], *72* (*1905*), *Nos. 1873, pp. 510–512; 1875, pp. 562, 563; 73* (*1906*), *No. 1892, pp. 331, 332*).—A summary account of proceedings of this conference held at Innsbruck September 9–15, 1905, under the presidency of J. M. Pernter.

In his opening address the president discussed particularly the importance and progress of exploration of the upper air and the problem of weather periods and their connection with and dependence on the activity of the sun. Among the subjects receiving particular attention were investigations of excessive rainfall, solar radiation, long series homogeneous observations, meteorological observations during the last century, island meteorological stations, and use of wireless telegraphy to announce the approach of storms.

Japanese meteorological service in Korea and China, S. T. TAMURA (*Science, n. ser., 23* (*1906*), *No. 584, pp. 396, 397*).—The organization of a series of stations under the supervision of the Chemulpo Meteorological Observatory and their equipment are briefly described.

Climatic notes on the Sahara, E. F. GAUTIER (*Ann. Géogr., 14* (*1905*), *No. 78, pp. 459–461; Bul. Amer. Geogr. Soc., 38* (*1906*), *No. 1, pp. 32–34; abs. in Science, n. ser., 23* (*1906*), *No. 588, p. 555*).—The more important climatic facts brought out in this report are that strictly desert conditions are not as extensive in the Sahara as is generally believed; and that there have been three epochs in the climatic history

of the region, the first marked by conditions which supported a dense population (of the neolithic period), the second by desert conditions, and the third, or present period, in which the land is gradually assuming a steppe-like character.

The gradual desiccation of the region advanced from the Soudan, but to-day the rainbelt is again extending more and more toward the north. On the steppes, where the Soudan merges into the Sahara, the annual rainfall is 6 to 12 inches and supports considerable vegetable and animal life.

Texas rainfall during 1905 (*Texas Farm and Ranch, 25 (1906), No. 10, p. 3, fig. 1*).—A map with brief notes furnished by E. E. Spencer, director of the Texas section of the Weather Bureau, is given. The average annual precipitation for the State as determined from reports of 87 stations was 44.49 in., or 12.55 in. above the normal. The greatest annual precipitation was 86.32 in. at Jefferson, the least 17.8 in. at El Paso. The heaviest rainfall occurred over the eastern, northeastern, central, and coast regions of the State.

Rainfall in the agricultural districts, G. G. BOND (*Queensland Agr. Jour., 16 (1906), No. 5, p. 380*).—A table is given which shows the total rainfall for each month from December, 1904, to December, 1905, inclusive, in 41 agricultural districts of Queensland.

The relation of forests to rainfall, W. F. HUBBARD (*Mo. Weather Rev., 34 (1906), No. 1, pp. 24-26, figs. 2*).—The distribution of forests as dependent upon rainfall is illustrated by conditions in California, and it is shown that "topography and winds are the controlling factors in the distribution of forests. They make most of the Pacific coast a region of winter rains and summer droughts, and, away from the coast, limit the forests to the higher altitudes. . . . As rainfall determines the presence or absence of forests, so the configuration of the land and its relation to water bodies and constant winds determine the rainfall."

Forests and rainfall in Silesia, J. SCHUBERT (*Ztschr. Forst u. Jagdw., 37 (1905), No. 6, pp. 375-380, figs. 3; abs. in Met. Ztschr., 22 (1905), No. 12, pp. 566-570, figs. 3, and Science, n. ser., 23 (1906), No. 589, p. 593*).—This subject is discussed on the basis of the rainfall map published by Hellmann in 1899, the conclusion reached being that forests seem to produce an increase in precipitation. This is ascribed to the fact that forests retard wind movement and promote rise and cooling of the air. If one-half of the observed difference is set down as being due to the increased protection of the gauges set up in or near the forests, the actual effect of the trees themselves would roughly correspond to an increase in altitude of 40 meters.

Prevention of damage by frost, R. P. SKINNER (*Mo. Weather Rev., 34 (1906), No. 2, pp. 79, 80*).—Tests of various smudges and the use of potash salts as fertilizers are reported, which, while not conclusive, indicate that more or less protection may be afforded in some cases by such means.

Cloud studies, A. W. CLAYDEN (*London: John Murray, 1905, pp. XIII+184, pls. 61; rev. in Nature [London], 73 (1906), No. 1896, pp. 416, 417, figs. 2*).—In his review of this book Prof. H. H. Hildebrandsson states that it will be a standard work for all students of clouds. The author accepts the types of the International Cloud Atlas and arranges his various forms as subforms of these types with the exception of the nimbus cloud, which he classifies as a subform of the stratus type.

On cloud formation in the Alpine valleys.—Contributions to the mechanism of cloud formation, H. VON FICKER (*Ber. Naturw. Med. Ver. Innsbruck, 29 (1903-4, 1904-5), pp. 193-275*).—A series of observations at various elevations to study especially the formation of stratus clouds in inland valleys is reported.

Apparatus for observing and recording storms (*Sci. XX. Siècle, 1905, Aug. 15, Sup.; abs. in Rev. Sci. [Paris], 5. ser., 5 (1906), No. 9, pp. 278, 279*).—An apparatus devised by A. Turpain, of the meteorological observatory of Puy-de-Dôme for photographically and automatically recording the electrical condition of the atmosphere during storms is described.

A possible extension of the period of weather forecasts, E. B. GARRIOTT (*Mo. Weather Rev., 34 (1906), No. 1, pp. 22, 23*).—A study of counterbalancing tendencies with regard to weather abnormalities in different parts of the globe leads to the conclusion that with completion of daily telegraphic communication with the dominating "centers of atmospheric action" over Siberia, the Alaskan coast, the Azores, and Iceland, "daily available forecasts can undoubtedly be made of the general character of the weather for at least one week in advance. Such general forecasts could specify the character, whether warm or cold, wet or dry, of the weather of the near future, and could indicate the duration and termination, days in advance, of periods of abnormal weather."

Public water supply of Ohio (*Ann. Rpt. Bd. Health Ohio, 19 (1904), pp. 61–343*).—Reports are given on plans for water supplies or sewerage proposed during 1904 for a large number of places in Ohio.

The results of laboratory examination of waters, sewage, and sewage effluents, and studies of methods of purification are also reported in detail.

It is stated that "with but few exceptions the surface waters of the State are unsuited for a public supply. In many regions the ground water is inadequate for a city of much size. The purification of surface waters must receive more and more attention. A filtration plant must be properly constructed and efficiently operated to afford a safe water supply."

It is suggested that "it would seem not improper for the State Board of Health to collect the evidence to show that the water supply of any city is dangerous to life and health. The attorney-general might present this evidence to a court of competent jurisdiction—to the supreme court, if possible. If satisfied that conditions were such that public interests warranted and demanded it, this court should have authority to compel the city to make necessary improvements within a reasonable time."

Seventy-one cities and 177 villages, representing 55 per cent of the population of Ohio, had a public water supply in 1904.

The sources of water supply in Wisconsin, W. G. KIRCHOFFER (*Bul. Univ. Wis., No. 106, pp. 163–267; abs. in Engin. News, 55 (1906), No. 13, pp. 355, 356*).—It is stated that of the 270 cities and villages in Wisconsin 120 are provided with a public water supply. Fifty of the latter use artesian water, 30 ground water, 14 lake water, 12 river water, and of the remainder the source of supply is not definitely known. Of the artesian well supplies, 27 are from Potsdam sandstone, 10 from St. Peters sandstone, and the remainder from both.

As regards the amount of water used from the various sources, lake waters rank first, artesian waters second, ground waters third, and river waters fourth. As to sufficiency or quantity, lake waters rank first, river waters second, artesian waters third, and ground waters fourth, and as to purity, artesian waters rank first, lake waters second, ground waters third, and river waters fourth. The most serious troubles with artesian waters were hardness and presence of iron.

The biology of water bacteria, E. KOHN (*Centbl. Bakt. [etc.], 2. Abt., 15 (1906), Nos. 22–23, pp. 690–708, figs. 3; 25, pp. 777–786*).—This article reports studies on the general course of multiplication of micro-organisms and changes in the composition of the bacterial flora when water is allowed to stand and the food requirements of a series of saprophytic fresh-water micro-organisms.

The bacterial flora was found to change quantitatively and in composition when large samples of sweet water were allowed to stand for a long time. The increase in germination was greatest in vessels of the kinds of glasses which were the most soluble in water. The phosphorus thus dissolved from the glass was sufficient for the requirements of the organisms. The organisms were found to vary widely with regard to their behavior toward the nutrient solutions, particularly the concentration of grape

sugar and ammonium sulphate solutions supplied. Three per cent grape-sugar solution was found to be too strong for *Urobacillus pasteuri.*

Experiments with copper-iron sulphate for water purification at Marietta, Ohio (*Engin. Rec., 53 (1906), No. 12, pp. 392-394, figs. 4*).—The successful use of a mixture of copper and iron sulphates precipitated with caustic lime and held on the filter for precipitation of impurities and reduction of the number of bacteria in water is reported.

SOILS—FERTILIZERS.

Soils, T. DIETRICH and F. HONCAMP (*Jahresber. Agr. Chem., 3. ser., 7 (1904), pp. 25-99*).—A review is given of the literature relating to this subject published during 1904, classified as follows: Rocks, stones, and their weathering products; cultivated soils, including analyses of soils, physics of soils and absorption, and the lower organisms of soils; and moors and moor culture.

Mechanical analysis of soils, J. A. MURRAY (*Chem. News, 93 (1906), No. 2409, pp. 40-42; abs. in Analyst, 31 (1906), No. 361, pp. 129, 130*).—This article describes "a long tube sedimentation process."

The apparatus employed consisted of an Erlenmeyer flask (of about 200 cc. capacity) of which the neck, after removal of the flange, was exactly the same diameter as a long glass tube which was attached to it by means of a piece of india-rubber tubing fitted outside of the tube and of the neck of the flask. The tube actually used was 147 cm. long by 2.3 cm. internal diameter. "A wide shallow glass basin about 20 cm. diameter and a few small porcelain evaporating dishes about 7.5 cm. diameter are also necessary. . . .

"The experiment was carried out as follows: Five gm. of the air-dried fine soil (i. e., that which had passed through 100-mesh sieve), thoroughly disintegrated in dilute ammonia solution, was put into the flask, which was then vigorously shaken, filled nearly full of water, and attached to the tube. Water was then poured gently down the side of the tube (so as not to disturb the sediment in the flask) till it also was full, when the open end was closed with a cork, and the whole inverted over the large basin of water. The cork closing the end was immediately withdrawn, and one of the small porcelain evaporating dishes, previously dried and weighed, placed beneath the open end of the tube.

"The sediment began to descend whenever the tube was inverted, and the first particles were deposited in the dish in about fifteen seconds. After a short interval this dish, containing the first portion, was removed and replaced by another, and this again by a third, and so on. These dishes containing the several fractions of the sediment thus removed from the large basin were of course full of water, of which, however, a considerable part was separated by simple decantation, after standing for a few minutes, and the remainder driven off on the water bath. The dried residue was then weighed, and examined under the microscope for determination of the size of the particles."

Results of tests of the method on a sample of stiff clay soil and of Rothamsted soil are reported.

It was found advisable in case of the heavier soil to make a preliminary rough separation of the finer and coarser material by shaking with weak ammonia, allowing to stand 15 minutes, and pouring off the solution containing the fine material in suspension. The coarser material was introduced into the apparatus described and separated into 3 fractions, viz, those separating in 5, 15, and 40 minutes after the beginning of the test. Preliminary separation was not necessary in case of the lighter Rothamsted soil.

A chemical study of some Oregon beaver-dam soils, C. E. BRADLEY (*Jour. Amer. Chem. Soc., 28 (1906), No. 1, pp. 64, 65*).—Analyses of 5 samples of beaver-dam

soils of the Willamette Valley, one of which is virgin and the others have been used for a number of years in onion growing, are reported.

These soils when virgin are composed largely of organic matter of a peaty nature. They are porous, light, and loose, with no tendency to bake or form lumps. The analyses show that their nitrogen content is large. Potash is present in liberal quantities, but is of low availability. Phosphoric acid is not deficient and is largely in available form. The soils contain sufficient lime to keep them sweet, and lime is always in excess of magnesia.

The nitrogen content of the virgin soil was 1.56 per cent and varied from 0.78 to 2.06 per cent in 3 of the cultivated soils. The total potash content was 0.14 per cent in the virgin soil and varied from 0.1 to 0.28 per cent in the other soils. The phosphoric-acid content was 0.26 per cent in the virgin soil, varying from 0.21 to 2.3 per cent in the cultivated soils. The availability of the potash and phosphoric acid was determined by digestion in 0.5 per cent hydrochloric acid.

Report on the soils of Dorset, with suggestions on manuring, cultivation, etc., J. PERCIVAL (*Univ. Col. Reading, Agr. Dept., Ann. Rpt. Soils Dorset, 7 (1905), pp. 50, map 1*).—This report summarizes in a simple manner the more practical results of the analyses of 100 samples of soil from various parts of Dorsetshire which have been previously reported (E. S. R., 15, p. 857), the information being adapted especially to those engaged in farming in Dorset.

"The first part of the report contains general information as to manures. In this part will be found a description of some of the chief kinds of manures and suggestions as to the use of manures for various crops. Some notes on grass mixtures are also given. The second part of the report contains a description of the various kinds of soils in the county according to their geological formations; and suggestions are given on points connected with the manuring and cultivation of each class of soil, largely based upon the analyses of typical soils, of which a list (with the results) is given for each district."

A geological map is given which makes it possible to locate the different classes of soils discussed. It is shown that a large proportion of the area consists mainly of chalk formation, while another large area is occupied by a series of sands of low fertility. The chief deficiency of the chalk soils seems to be potash.

On loess soils and loess marls, HALENKE, KLING, and ENGELS (*Vrtljschr. Bayer. Landw. Rat., 10 (1905), No. 3, pp. 447–455*).—This article describes the various types of loess occurring in the Rhenish Palatinate and discusses their origin and transformations, especially their changes in lime content. Examinations of a large number of samples show a variation of 0.08 to 6.05 per cent of lime in the surface soil and 0.19 to 47 per cent in the subsoil, ranging from pure sandy loess to loess marl. The chemical and physical make-up of the latter is considered in detail.

The fertilizer requirements of Hessian soils, E. HASELHOFF (*Das Düngungsbedürfnis der hessischen Böden, pp. 39; Fühling's Landw. Ztg., 55 (1906), No. 3, pp. 73–81*).—The composition and fertilizer requirements, as determined by pot experiments, of Hessian soils of different geological origins are discussed.

The soils tested were of basalt, bunter-sandstein, shell lime, graywacke, and clay slate types. The composition of the different soils and of the rocks from which they were originally derived is given. All of the soils responded to applications of nitrogen. Their behavior toward potash was variable, depending upon their origin and content of available potash as shown by analysis. The basalt, shell lime, and clay slate soils were benefited by applications of phosphoric acid, the graywacke soils did not respond to such applications, and bunter-sandstein soils varied in their behavior toward phosphoric acid according to the amounts of available phosphoric acid present as shown by analysis. Only the basalt soils showed a need of lime. It was concluded that pot experiments are a reliable means of determining the fertilizer requirements of soils.

The effect of plant growth and of manures upon the retention of bases by the soil, A. D. HALL and N. H. J. MILLER (*Proc. Roy. Soc. [London], Ser. B, 77 (1905), No. B514, pp. 1–32, figs. 2; abs. in Jour. Chem. Soc. [London], 90 (1906), No. 520, II, pp. 119, 120*).—The investigations reported in this article deal "with the changes in the amount of calcium carbonate, the chief substance in the soil acting as a base, which are brought about by natural agencies, by manuring, and particularly by the growth of plants."

It is stated that the Rothamsted soils generally contain about 3 per cent of calcium carbonate, due mainly to former applications of chalk. "Determinations made in numerous samples from different plats of Broadbalk, Agdell, and Hoos fields, taken at different dates from 1856 to the present time, show that the soils of the unmanured plats lose in drainage on the average about 1,000 lbs. of calcium carbonate per acre per annum. This agrees closely with results derived from analyses of field drainage by Creydt, von Seelhorst, and Wilms [E. S. R., 13, p. 723; 16, p. 856].

"The loss of calcium carbonate is increased when ammonium salts are employed by an amount equivalent to the acid of the manure. Sodium nitrate and farmyard manure diminish the loss.

"Analyses of wheat plants grown in water culture and of the solutions themselves showed that the plants take up an excess of acid from the salts supplied, leaving behind a corresponding excess of base. This explains how it is that, despite losses by nitrification, soils which contain only minute amounts of calcium carbonate (examples of such soils are given) are able to maintain a neutral condition. The experiments also furnished evidence that the roots of the plants did not excrete any organic acid or other organic matter.

"Finally it is shown that calcium oxalate and other organic salts are converted into carbonate by soil organisms."

Investigations on changes in the nitrogen of soils, F. LÖHNIS (*Mitt. Landw. Inst. Leipzig, 1905, No. 7, pp. 1–105; Centbl. Bakt. [etc.], 2. Abt., 15 (1905), Nos. 12, pp. 361–365; 13–14, pp. 430–435; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 518, II, p. 854; 90 (1906), No. 519, II, p. 46*).—The investigations here reported were made on soil of a plat on the Oberholz experimental field of the agricultural institute of the University of Leipzig during 1903 and 1904.

Oats were grown on the plat in 1903, and after these were harvested half of the area was given shallow cultivation while the other was left in stubble. In 1904 the field was planted in potatoes, which received applications of the various fertilizers (bone meal, lime nitrogen, urea, ammonium sulphate, sodium nitrate, etc.), the transformations of which it was the purpose of the experiments to study, namely, the formation of ammonia from bone meal, lime nitrogen, and urea; the formation of nitrate from ammonium sulphate; the liberation of nitrogen from nitrate, and the fixation of nitrogen by bacteria. The influence of the time of year (temperature), weather, and of various methods of culture on the yields and utilization of the nitrogen of the different fertilizers was also studied, and the different kinds of bacteria which took part in the transformation of the nitrogen were isolated and determined.

Decomposition was least affected by the season of the year in case of bone meal and most in case of urea and calcium cyanamid. The nitrogen of calcium cyanamid was quickly converted into ammonia during April and May, and its effect on the crop was similar to that of ammonium salts. It was found that *Bacillus mycoides* converted 39 per cent and *Bacterium vulgare* 28 per cent of the total nitrogen of bone into ammonia in 3 weeks. Allowing the soil to remain in stubble had a distinct effect on denitrification and nitrogen assimilation, but not on the other changes.

The chief effect of bringing the lower layers of the soil to the surface was to diminish nitrification, the least effect being observed in the case of decomposition of bone meal and urea, while there was no effect as regards nitrogen assimilation and decomposition of calcium cyanamid. Dry weather in July was especially injurious as

regards nitrification, nitrogen assimilation, and the decomposition of calcium cyanamid, but was practically without effect on denitrification and decomposition of bone meal and urea. It is concluded that water to the extent of from 60 to 80 per cent of the water-holding capacity of the soil is required for the uninterrupted progress of the various changes in the nitrogen of the soil.

In these investigations soil extracts were used as a culture medium with good results. These extracts were prepared by boiling 1 kg. of soil for 2 hours with 2 liters of tap water. The solution, evaporated to a volume of about 800 cc., was cleared up with talc and filtered, and the filtrate was evaporated until it contained about 0.4 per cent of inorganic constituents. In this way 1 kg. of soil gave as a rule about 600 cc. of neutral extract containing 0.4 per cent of inorganic and 0.6 per cent of organic constituents. The nitrogen content was about 0.02 per cent and the solution was almost entirely free of phosphoric acid. Except in the case of the experiments with bone meal, therefore, about 0.5 per cent of dipotassium phosphate was added. In the experiments reported this extract was inoculated with soil, using the latter at the rate of 10 gm. of soil to 100 cc. of solution.

Report of the chemical laboratory of the Ploti Agricultural Experiment Station, B. M. Welbel (*Ghodichnuĭ Otchet Ploty. Selsk. Khoz. Opuitn. Stantziĭ, 10 (1904), pp. 75–120; abs. in Centbl. Agr. Chem., 35 (1906), No. 2, pp. 73–76*).—A continuation and extension of previous work (E. S. R., 16, p. 552) on atmospheric precipitation, lysimeter observations, and experiments in vegetation boxes is reported.

The report deals with studies of the adaptability of lysimeters to the investigation of questions relating to the balance of water and nitrogen in the soil as influenced by variations in precipitation, methods of culture, manuring, etc. Three groups of lysimeters installed at the station and the kind of investigations for which they are used are described. It has been found that the method of construction and of filling the lysimeters has a most important bearing upon the results obtained.

Special attention has been given in the experiments with the lysimeters to a comparison of the influence of black fallow and green fallow on the water and nitrogen content of the soil. Black fallow as practiced in these experiments consisted of cultivating the soil and allowing it to lie idle until the following fall. Green fallow consisted in allowing the land to lie without cultivation from one summer to the next. More water accumulated in the lower layers of the black fallow soil than in those of the green fallow, the reverse being true for the upper layers of the soil, but in the latter case the differences were very small.

The drainage was greater in case of the black fallow than in case of the green. There was a greater accumulation of nitrates and greater loss in drainage in the black fallow than in the green. The losses in the drainage were, however, more than made good by nitrogen compounds brought down from the air, aggregating 4.5 kg. of nitrogen per hectare annually. During three years of observation the application of barnyard manure increased the production of nitrates (nitric nitrogen) in the soil 120 kg. per hectare. During the same period soil bearing alfalfa produced 50.22 kg. of nitric nitrogen more per hectare than soil not bearing alfalfa.

Some field notes on soil inoculation, H. N. Starnes (*Georgia Sta. Bul. 71, pp. 91–105, pls. 12*).—The present status of knowledge regarding soil inoculation for legumes is briefly reviewed and experiments with commercial cultures of nitrogen-fixing bacteria on cowpeas grown in an isolated field of typical red-clay land in a low state of fertility are reported.

The experiments were made on fertilized and unfertilized areas of this soil. The results do not indicate any particular advantage from inoculation. "In yield of vines an increase appears per acre of 175 lbs., or about 3 per cent, in favor of the untreated over the inoculated plats, while in the yield of peas the difference is reversed, there being apparent an increase of 35 lbs. per acre, or something less than 5 per cent, in favor of the inoculated plats."

The conclusion is reached "(1) that few soils throughout middle Georgia are likely to be found not already thoroughly colonized or inoculated with the special form of *Pseudomonas radicicola* which uses the cowpea as its host. (2) Consequently, whether the commercially distributed 'cotton-dried' nitro-culture for the cowpea does or does not contain living colonies of this bacterium, it is valueless here."

Observations on a series of introduced leguminous plants indicate that the cowpea organism, which is everywhere abundant in the soils of the station farm, is capable of inoculating leguminous plants of widely differing species. Among the unusual plants so tested and found to develop root tubercles when grown for the first time on the station farm were green gram (*Phaseolus viridissimus*), Newman bean (*P. mungo*), *P. radiatus*, *P. aconitifolius*, and *P. angustissimus*.

"Now, the bacteria forming these tubercles were derived either from the soil itself (that is, from the universally disseminated cowpea bacteria) or were conveyed by the planted seed. The latter hypothesis, though possible, is unlikely, especially since desiccation has been proven so extremely fatal to *P. radicicola*. Had the seed been sterilized before planting it would have, of course, determined the matter; but the plat was merely a variety test of certain Phaseoli, with no reference to its bearing upon soil inoculation. In either case it seems to indicate that our soil is not dependent upon artificial inoculation."

Soil inoculation for legumes from artificial cultures by the help of bacteria, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 126, pp. 28-30*).—Negative results in inoculation experiments with peas, clover, and alfalfa on a number of farms in different parts of Maine during the season of 1905 are reported. The cultures used for inoculation were obtained from this Department and from a commercial concern. The farmers of the State are cautioned not to depend upon such cultures, but in case of attempts to raise leguminous crops not commonly grown in the region to inoculate their land with soil from fields on which the crops have been grown.

An experiment with Moore's cultures of nitrogen-fixing bacteria, V. Peglion (*Staz. Sper. Agr. Ital., 38 (1905), No. 9, pp. 769-784, pls. 4*).—The results of experiments with medic, lupines, sulla, and white clover on virgin and cultivated soils indicate as a rule that Moore's cultures were very active in producing root tubercles and in increasing growth in soils which had not already been inoculated by natural means; but the writer points out that such conditions are exceptional in localities where legumes of various kinds have been grown for centuries, and hence the cultures have only a limited usefulness in practice and should not be expected to take the place to any extent of good cultivation and the application of mineral fertilizers to promote the growth of legumes.

Nitrification of the organic matter applied to the soil in form of sewage, G. Masoni (*Atti R. Accad. Econ. Agr. Georg. Firenze, 5. ser., 2 (1905), No. 3, pp. 196-208*).—This is an account of a continuation of previous experiments by the author and relates particularly to the relation of moisture to denitrification.

The experiments here briefly reported lead to the conclusion that liquid sewage from cesspools is not only capable of rapidly nitrifying when applied to the soil, but also aids nitrification in the soil itself. Loss of nitrogen from the soil during hot dry summer weather may be checked by applications of sewage.

Recent experiments in the nitrogen-enrichment of soils, F. T. Shutt and A. T. Charron (*Separate from Proc. and Trans. Roy. Soc. Canada, 2. ser., 11 (1905), Sec. III, pp. 53-64*).—This paper (1) presents the results of certain recent researches that demonstrate the extent and rapidity of the depletion of soil nitrogen under what is evidently an irrational method of farming, and (2) brings forward data to show the value of the legumes, especially clover, as a means of maintaining and increasing fertility through the addition of nitrogen and humus. The discussion is based upon field and laboratory studies made by the authors at the Canadian Experimental Farms.

A new nitrogenous manure, J. HENDRICK (*Trans. Highland and Agr. Soc. Scot., 5. ser., 18 (1906), pp. 75-77*).—Field experiments on oats and barley with lime nitrogen as compared with nitrate of soda and sulphate of ammonia are briefly reported. The results show that the lime nitrogen was but slightly inferior to nitrate of soda or sulphate of ammonia. "In no case did any injury appear to be caused to the germination of oats or barley by using the cyanamid at the rate of 1 cwt. per acre along with the seed."

The conversion of atmospheric nitrogen into nitric acid, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 8, pp. 233-235*).—This article briefly reviews investigations on this subject and describes the various methods which have been proposed for fixing the nitrogen of the air, particularly that of Birkeland and Eyde.

Chemistry and the world's food, R. K. DUNCAN (*Harper's Mo. Mag., 112 (1906), No. 671, pp. 720-731*).—A popular review of progress in investigations relating to the utilization of the nitrogen of the air for industrial purposes, especially as a fertilizer.

Nitrogen requirements of crops, L. GRANDEAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 7, pp. 201-203*).—The demands of crops on the nitrogen of the air and the soil are briefly discussed.

It is estimated that the crops produced on the 24,000,000 hectares (9,716,575 acres) of land under cultivation in France remove about 273,000 metric tons more of nitrogen, 149,000 tons more of phosphoric acid, and 377,000 tons more of potash than is returned to the soil by farm manures. The most economical means of making up this deficit are discussed.

Fertilizers, E. HASELHOFF (*Jahresber. Agr. Chem., 3. ser., 7 (1904), pp. 100-229*).—A review is given of the literature relating to this subject published during 1904, classified as follows: Analyses of fertilizers and preservation of manure, results and methods of fertilizer control, and fertilizer experiments.

Commercial fertilizers, G. ROBERTS (*California Sta. Bul. 171, pp. 29, figs. 3*).—The results of fertilizer inspection during the year ended June 30, 1905, are reported, including analyses of 151 samples of fertilizers and notes on valuation, mechanical condition of fertilizers, etc., and the text of the fertilizer law.

Commercial fertilizers, G. ROBERTS (*California Sta. Bul. 173, pp. 26*).—This bulletin gives the results of fertilizer inspection during the six months ended December 31, 1905, including analyses of 138 samples of fertilizers and a list of brands of fertilizers and fertilizing materials offered for sale by the registered manufacturers and dealers in the State.

Fertilizer inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 127, pp. 47-64*).—This bulletin contains the analyses of manufacturers' samples of brands of fertilizers licensed before February, 1906, with explanations regarding constituents of fertilizers and valuation.

Commercial fertilizers, J. L. HILLS and C. H. JONES (*Vermont Sta. Bul. 121, pp. 81-104*).—This is the first bulletin issued in connection with the fertilizer inspection for 1906 and gives results of analyses of 56 brands. A table is also included showing the composition of 126 brands on sale in the State during the past 5 years. The character and contents of the more important previous bulletins of the station on fertilizers are explained and notes are given on valuation.

Commercial fertilizers, J. H. STEWART and B. H. HITE (*West Virginia Sta. Bul. 97, pp. CIII-CVII+108-170*).—This is the complete report of the work of fertilizer inspection in West Virginia during 1905, including analyses of 238 samples.

Commercial fertilizers, M. S. MCDOWELL (*Ann. Rpt. Penn. Dept. Agr., 10 (1904), pp. 135-155*).—This is a general discussion of the sources, nature, and uses of the various commercial supplies of nitrogen, phosphoric acid, and potash.

Artificial fertilizers, their functions and use, F. E. LEE (*Jour. Dept. Agr. Victoria, 3 (1905), No. 10, pp. 713-725, fig. 1*).—This article summarizes information

regarding the source, nature, and use of fertilizers, giving also suggestions regarding the mixing of fertilizers and a discussion of methods of valuation.

The fertilizer industry (*Tradesman, 54 (1906), No. 9, pp. 98, 99*).—Data are given for 10 southern States, showing 162 fertilizer establishments with an invested capital of $29,966,685 and a value of product of $18,921,591.

Mineral resources of the United States, calendar year 1904, D. T. DAY (*U. S. Geol. Survey, 1905, pp. 1264, pls. 2*).—The principal information of agricultural interest in this report has already been noted from another source (E. S. R., 17, p. 451).

Fertilizer trials at the Royal Agricultural Academy of Sweden, 1903–4, H. G. SÖDERBAUM (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 4–5, pp. 289–311, fig. 1*).—*On the after effects of different kinds of phosphatic fertilizers.*—This is a report of an investigation conducted since 1901, in which the effects of the following phosphatic materials have been studied: Superphosphate, dicalcium phosphate, tricalcium phosphate, precipitated phosphate, and bone meal. Different varieties of oats were grown in vegetation pots each year, and after the first year applications of sodium nitrate and potassium sulphate, with or without addition of calcium carbonate, were made each year.

The highest aggregate yields of oats for the four-year series were obtained from the applications of superphosphate and of dicalcium phosphate, and the action of these fertilizers appeared to be independent of whether or not lime had been added. The effect of both tricalcium phosphate and bone meal was reduced by nearly one-half during the four years by the addition of lime, and the superiority of the former over the latter in the case of the limed pots, and of bone meal over the tricalcium phosphate in the case of the pots receiving no lime, gradually disappeared, so that the total results for the entire series were practically the same. The action of bone meal (with no lime) was found to be decidedly inferior to superphosphate even after the fourth year.

The fertilizer value of Algerian phosphate and apatite compared with that of other phosphatic materials.—The trials were made in 10-in. glass cylinders, with oats grown in a sandy soil, and with peas grown in a marsh soil. In the former trials Algerian phosphate produced an increase of only 3.3 to 5.3 per cent over the cylinders receiving no phosphoric acid, the increase obtained in the case of superphosphate being placed at 100, and the increase in the case of the fine-ground apatite amounted to 0.4 to 1 per cent, according to the quantity of phosphoric acid added (50 to 150 kg. per hectare). In the latter trials with peas on marsh soil the effect of the sifted Algerian phosphate was about 57 per cent of that of superphosphate for peas alone, and 63.7 per cent for the entire crop (peas and vines). The corresponding figures obtained for apatite were 3.9 per cent and —1.4 per cent.

Culture trials to determine in how far the effect of phosphatic fertilizers depends on the character of the simultaneous nitrogenous fertilization.—It has been found in earlier investigations that the effect of superphosphate or dicalcium phosphate was not influenced by the kinds of nitrogenous fertilizer applied, but that the tricalcium phosphate and bone meal produced appreciably larger crops when mixed nitrogenous fertilizers were applied than when sodium nitrate only was added with the phosphates.

This subject was studied further by the author during the years 1902 to 1904. In pot experiments with Ligowo oats, in which different phosphatic materials were added with either nitrate of soda or nitrate of ammonia, the results obtained with superphosphate or Thomas phosphate were higher in the case of applications of nitrate of soda than when corresponding amounts of ammonium nitrate were applied, while the opposite held true with Algerian phosphate and with bone meal. The effect of applications of different nitrogenous fertilizers in connection with bone meal

was next studied, also for Ligowo oats, with the result that a marked increase in yields was obtained with ammonium sulphate.

The next highest results were secured in the case of fertilization with ammonium sulphate and sodium nitrate, while sodium nitrate alone with bone meal gave the lowest results, this effect being equally marked both in the yield of total crop and of grain. Liquid manure or albumen with sodium nitrate gave somewhat lower results than sodium nitrate and ammonium sulphate. The effect of the phosphatic fertilizers applied is, therefore, shown to depend to a large extent on the character of the nitrogenous fertilizers applied or present in the soil.

Culture trials with nitrogenous and phosphatic fertilization in increasing amounts.—These trials were planned to study the methods of pot experimentation. They were conducted in glass cylinders, 29 cm. deep by 24 cm. in diameter, filled with 28½ kg. of a sandy soil, low in nitrogen (0.011 per cent) and phosphoric acid (0.04 per cent phosphoric acid soluble in hot hydrochloric acid, sp. gr. 1.15), the crop grown being oats.

In the first series, in addition to a basic fertilization of fine-ground marble, superphosphate, and potassium sulphate, with a slight addition of magnesium sulphate and salt, sodium nitrate was added to different cylinders in amounts ranging from 1.5 to 6 gm. per cylinder (50 to 200 kg. per hectare). Increasing nitrogenous fertilizations in all cases produced an increase in the crops harvested, the increase being largest with the smallest amounts of nitrate applied and smallest with the heaviest applications, so that the increase obtained beyond applications of 150 kg. per hectare (134 lbs. per acre) may be considered within the limits of experimental error.

Both the weights of kernels and of straw increased with increasing applications of nitrate. The ratio of straw to kernels was narrowest in the case of the largest amounts applied, up to 125 kg. per hectare, when a small widening of the ratio began to appear. It was found, in general, that a fertilization of 150 kg. per hectare (= 0.026 gm. per kilogram of soil) produced an optimum development of the crop, and that the crop produced on a fertilization of 50 kg. of nitrate by its appearance gave decided evidence of a lack of proper nitrogenous fertilization.

In the second series the trials were conducted under similar conditions as in the case of the preceding series; 0.71 to 5.71 gm. of superphosphate (corresponding to 25 to 200 kg. per hectare) were added to sets of 3 cylinders each. The increase in the oat crop harvested from the different cylinders was less regular in this than in the preceding series. The highest increase was obtained between 25 and 50 kg.; between 75 and 125 kg. only a small increase in yield was secured, while at 150 kg. a marked increase again occurred, the maximum crop being obtained at 175 kg. Between 175 and 200 kg. a decrease in yield occurred. The optimum results evidently lay between 75 and 150 kg., and may be placed at 0.017 gm. per kilogram of soil for the soil experimented with and under the conditions of these trials.—F. W. WOLL.

On the factors which influence the fertilizing value of the phosphoric acid of bone meal, H. G. SÖDERBAUM (*Landw. Vers. Stat.*, *63* (*1905*), *No. 3-4*, *pp. 247-262*).—Experiments in glass cylinders 50 cm. high and 25 cm. in diameter carried out with oats during 1902 and 1903 are reported. (See also the preceding abstract.) They included comparative tests of superphosphate, dicalcium phosphate, tricalcium phosphate, Thomas slag, Algerian phosphate, apatite, and bone meal alone or combined in various ways with sodium nitrate, ammonium nitrate, ammonium sulphate, and other nitrogenous fertilizers (some organic), the object of the combination being to determine the influence of the different nitrogen compounds on the availability of the phosphoric acid of the phosphates, as has also been done by Prianishnikov (E. S. R., 17, p. 538).

The results show that the bone meal in presence of ammonium salts, as well as of organic nitrogen compounds, gave larger yields than when used in connection with

nitrate of soda alone. Similar results were obtained with Algerian phosphate and precipitated tricalcium phosphate. An increase of yield was produced by mixtures of nitrates and ammonium salts as well as by ammonium salts alone, the maximum increase occurring in case of the latter. The yield of grain was, as a rule, increased more than that of straw, the greatest increase of straw being, as a rule, with applications of organic nitrogen compounds. The increase due to applications of ammonium salts varied widely from year to year with the weather conditions.

Under favorable conditions the total yield was more than doubled, the yield of grain nearly tripled by the bone meal. In case of superphosphate, Thomas slag, and precipitated dicalcium phosphate there was no such increase of yield following the application of ammonium salts. In fact, in some cases there was a decided decrease in yield. When lime was not present in large amounts the bone meal in combination with ammonium salts was fully as effective as superphosphate.

Methods of using untreated rock phosphate, E. T. MEHARRY (*Ill. Agr., 10 (1906), No. 5, pp. 173–177*).—This is a summary of experiments by the Maryland, Ohio, and Illinois stations on the fertilizing value of untreated rock phosphate.

Manurial value of molasses residue as compared with ammonium sulphate and 40 per cent potassium salts, LILIENTHAL (*Illus. Landw. Ztg., 25 (1905), No. 34, pp. 319, 320; abs. in Jour. Chem. Soc. [London], 88 (1905), No. 516, II, p. 650*).—The dried molasses residue used in the comparative tests here reported contained 3.5 per cent of nitrogen and 13 per cent of potash, but no phosphoric acid. The residue produced about the same yield of potatoes as the mixture of ammonium sulphate and 40 per cent potash salt, with which it was compared. The quality of the potatoes produced was good.

The development of the potash industry, H. PRECHT (*Ztschr. Angew. Chem., 19 (1906), No. 1, pp. 1–7*).—A brief review of the history and present status of this industry.

German potassium deposits, W. SCHMIDTMANN (*Amer. Fert., 23 (1905), No. 6, pp. 22–24*).—A brief explanation of the formation of these deposits is given, and a doubt is expressed as to whether like deposits of equal strength and purity exist in any other country.

The use of lime in agriculture, D. A. GILCHRIST (*Jour. Bd. Agr. [London], 12 (1905), No. 7, pp. 400–406; Trinidad Bot. Dept. Bul. Misc. Inform., 1906, No. 49, pp. 18–22*).—A summary of available information regarding sources of supply, methods of application, and action of lime in the soil, considered mainly from the British standpoint.

Corncobs as fertilizers and as fuel (*Industrialist, 32 (1906), No. 17, pp. 270, 271*).—Compiled analyses are reported to show that corncobs have very little value as fertilizer (2 lbs. of nitrogen, 0.4 lb. of phosphoric acid, and 6.8 lbs. of potash, worth $1.36) and less than that of barnyard manure, wheat straw, or corn stalks. They are of more value as fuel ($2 per ton if wood is worth $6), and the resulting ashes are rich in potash (about 50 per cent). The feeding of charred cobs to poultry and hogs for tonic or medicinal purposes is recommended.

Dead leaves as a fertilizer (*Mo. Consular and Trade Rpts. [U. S.], 1905, No. 303, p. 276*).—A brief note is given on a report from the U. S. consul at Nantes on the relative fertilizing value of the leaves of different trees. From the results reported it is concluded that 44 lbs. of pear leaves, 80 lbs. of poplar, 51 lbs. of peach, 83 lbs. of locust, 82 lbs. of elm, and 174 lbs. of vine, respectively, are equal in nitrogen to 100 lbs. of ordinary manure.

Hog bristles as a fertilizer, E. MIÈGE (*Jour. Agr. Prat., n. ser., 11 (1906), No. 5, p. 145*).—This material contains about 9 per cent of nitrogen, which is very slowly available in the soil. The improvement of its availability by treatment with superheated steam, acids, etc., or by composting, is suggested. It is stated that gardeners have used the material with success for destroying slugs.

Bat guano from the Federated Malay States, W. R. DUNSTAN (*Agr. Bul. Straits and Fed. Malay States, 4 (1905), No. 10, pp. 394-397*).—Descriptions and analyses are given of 4 samples of bat guano obtained from caves in different parts of the Malay States. The results show that although these guanos are comparatively rich in phosphoric acid (8.6 to 17.52 per cent), of which a fairly large proportion (3.25 to 9.75 per cent) is soluble in ammonium citrate solution and is therefore in condition to be readily utilized by plants, they are deficient in the very important constituents, potash (0.88 to 2.01 per cent) and nitrogen (0.84 to 2.47 per cent).

Water as a plant food, BACKHAUS (*Chem. Ztg., 29 (1905), No. 80, p. 1067; Fühling's Landw. Ztg., 54 (1905), No. 22, pp. 757-762*).—Observations made on the Berlin sewage farm during the dry season of 1904 on the value of water as a factor of production are briefly reported, and the actual money value of the increase due to the application of 1 cubic meter of water in case of oats, wheat, hemp, and grasses is calculated. The latter varied from 1.35 cts. in the case of grass to 2.57 cts. in the case of oats.

The conditions necessary to the fullest and most economical use of water in plant production are also discussed, including increasing rainfall by forest planting, storage of water and construction of other irrigation works, deep culture, increasing humus content of the soil, controlling the water content and evaporation, choice of cultivated plants, tillage, etc.

FIELD CROPS.

The breeding of agricultural plants, C. FRUWIRTH (*Die Züchtung der landwirtschaftlichen Kulturpflanzen. Berlin: Paul Parey, 1905, pp. XVI + 201, figs. 25*).—Previous volumes of this work have already been noted (E. S. R., 16, p. 1065). This volume, the third of the series, treats of breeding potatoes, Jerusalem artichokes, flax, hemp, tobacco, hops, and leguminous forage plants, including clovers. Thirty different species are discussed and notes on the blossoming period, pollination, selection, correlation, variation, hybridization, and seed culture are given. A bibliography of 54 references, including books, bulletins, and periodicals, is listed.

Report of work at McNeill Branch Experiment Station for 1904, E. B. FERRIS (*Mississippi Sta. Bul. 87, pp. 7-16*).—In a corn fertilizer test the same quantities of nitrogen and phosphoric acid gave practically the same yields when given as cotton-seed meal and acid phosphate, cotton-seed meal and reverted acid phosphate, or raw ground bone. The cotton-seed meal was applied at the rate of 84 lbs., the acid phosphate 232 lbs., the reverted acid phosphate 414 lbs., and the raw ground bone 166 lbs. per acre. In a variety test with corn, Cocke Prolific and Eureka headed the list with yields of 51.6 and 51.5 bu. per acre, respectively.

In a fertilizer test with cotton 126 lbs. per acre each of acid phosphate and cotton-seed meal gave 700 lbs. of seed cotton; 165 lbs. of ground bone, 780 lbs. of cotton; and 168 lbs. of cotton-seed meal and 70 lbs. of acid phosphate, 710 lbs. of cotton per acre. Nearly all other applications gave much lower yields. Among the different varieties tested Allen Long Staple stood first in the production of seed cotton. The average of plats with the rows 4 ft. apart gave 742 lbs. of seed cotton per acre, which was considerably better than was obtained from narrower plantings.

Cowpeas grown as a second crop matured after the rainy season was over and made good hay. It is stated that peas planted early in the season have very little tendency to make fruit, while those planted the latter part of June or in July are likely to fruit heavily. A large and profitable crop of sweet potatoes was grown, the leading variety being Dooly Yam.

In work with sugar cane 420 gal. of first-class sirup was secured on one-half acre of plant cane. Immature tops of cane and tops with only one mature joint were used for planting, but were found unsatisfactory. It is estimated that the yield of

cassava roots secured at the station was at the rate of 15,000 lbs. per acre. Few crops are believed to equal it in tonnage on the sandy soils on which it was tested.

Deep preparation for corn, with shallow cultivation, gave better results than other methods of treatment, while with cotton deep preparation and deep cultivation gave practically the same yield as deep preparation and shallow cultivation. The deep preparation of the land consisted of subsoiling to a depth of 18 in. during the spring of 1903 and plowed to a depth of 5 in. during the spring of 1904, while for shallow preparation the ground was broken 5 in. deep during both seasons.

An inoculated plat of vetch grew to be waist high and was very strong and vigorous, while an uninoculated plat gave very poor results. Notes are also given on rape and Bermuda grass which were grown at the station.

Report of field work done at the [Mississippi] station for 1904, W. R. PERKINS (*Mississippi Sta. Bul. 88, pp. 13*).—Among 10 varieties of short staple cotton the highest total value per acre, $49.02, was produced by Cook Improved. The production of the least remunerative variety, Berry Big Boll, was equal in value to $26.59. John Bull, a long staple cotton, and Cook Long Staple produced values equal to $52.78 and $52 per acre, respectively. It is pointed out that the growing of long staple cotton is not always the most profitable. The different varieties here tested are briefly described.

Ten varieties of corn were tested and among them Hick Improved Marlboro stood first with a yield of 55.8 bu. per acre, followed by Columbian White Mammoth with 52.3 bu. The yields of soy bean hay from 4 varieties ranged from 3,880 to 6,148 lbs. per acre. Yields of Johnson grass hay on 3 different plats varied from 3.75 tons per acre to 5.91 tons. From an average fertilizer application of 87½ lbs. of cotton-seed meal and 100 lbs. of nitrate of soda a profit of $4.93 per acre was secured in growing Johnson grass hay. The experience of the station in growing alfalfa has been that crab grass is likely to kill out the alfalfa plants.

The comparative value of oats, cowpeas, and corn for the production of forage was studied. The value of corn fodder per acre amounted to $14.14, of cowpea hay to $14.63, and of oats and cowpea hay to $16.11.

Report on field crops at the Sugar Experiment Station, Audubon Park, New Orleans (*Louisiana Stas. Rpt. 1905, pp. 3–9, figs. 2*).—It is reported that seedling canes D. 74 and D. 95 have maintained the high standard of previous years. This season D. 74 tasseled in several places in the State as well as in Florida, and it is hoped that seedlings originating in Louisiana may be produced. Promising results secured in tests with cane loaders and harvesters are reported, and it is stated in this connection that D. 74, standing erect and withstanding storms far better than the native canes, presents less difficulty to harvesting with machinery.

Among notes on various crops grown at the station it is reported that maximum yields of 3,162 lbs. of seed cotton and 3,140 lbs. of cured alfalfa hay per acre were secured.

Cereal investigations (*Kansas Sta. Rpt. 1905, pp. 20–26*).—A description is given of cooperative experiments with the Bureau of Plant Industry of this Department in the testing of newly introduced varieties, and of hybrids and selections of cereal crops.

The work is carried on at McPherson and Fort Hays. Many of the results secured have already been noted (E. S. R., 17, p. 129). The yields of the different varieties of cereal crops grown in 1904 are tabulated and the extent of the plantings for 1905 is outlined. The weather conditions and the growth of the various crops during the season are discussed and the rainfall for the year beginning July 1, 1904, is recorded.

The prevention of lodging in cereals (*Rev. Gén. Agron., 15 (1906), No. 1, pp. 18–21*).—The lodging of cereals is discussed and a method of preventing it described. It was found that on very rich soil by mowing luxuriantly growing grain when 30

cm. high, removing the upper 15 cm., and leaving the cut material as it falls will not only prevent lodging but will also make a more uniform crop in length of straw and size of head and kernel. If after the first cutting the growth of the crop is vigorous enough to indicate danger of lodging, it may be cut again about 2 weeks later when the plants have again reached the height of 30 cm. The mowing should be done when the dew is off, preferably in the afternoon. This method was successfully applied in 1901 on Chevalier barley growing on rich and well-fertilized soil during a warm, rainy season.

Prout's farm, an example of 45 years' continuous culture of cereals without manure, B. Skalweit (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 8, Sup. 8, pp. 13–16*).—The general management of the farm, the crop rotations followed, the use of commercial fertilizers, the cost of production, and the value of the crops produced are briefly discussed.

Report on experiments carried out at Bramford and Saxmundham by the East Suffolk Education Committee, T. H. Middleton (*Cambridge Univ., Dept. Agr., 1904, pp. 48, dgm. 1*).—A rotation experiment was conducted to study the effects of different kinds of plant food on common crops. The crops grown in the rotation were roots, barley, clover or beans, and wheat. The fertilizers used were nitrate of soda, superphosphate of lime, and muriate of potash.

The importance and value of these three fertilizers varied with the soil and the crop. On clay soil nitrate of soda was of great value to mangels and of some value to barley; superphosphate, to clover, mangels, and barley, while potash had little or no effect. On light soil nitrate of soda benefited mangels and barley, and muriate of potash mangels and clover; but superphosphate did not benefit any of the crops. The continuous use for 12 years of 2 cwt. of nitrate of soda per acre on the light soil did not deteriorate the land, while a similar use of superphosphate was injurious to mangels and apparently, to a slight extent, to some of the other crops. The continued use of barnyard manure for 12 years on this light soil did not result in any appreciable accumulation of fertility.

In the second rotation experiment the quantities of manures to be used, the time of their application, and their effect were studied. The best results were secured by using 1 cwt. of nitrate of soda and 5 cwt. of superphosphate of lime per acre for the root crop, 2½ cwt. of superphosphate for barley, the same quantity the following season for clover, and 10 tons of barnyard manure for the wheat crop. The experiment further showed that residues of fertilizer applications may have substantial values, varying, however, with the crop. Clover extracted more from residues than barley and barley more than roots. It was shown that clover may receive great benefit from superphosphate applied a year before the crop is sown, while mangels appear to be benefited very little by the same treatment. It was also shown that the residue of any particular application is greatly influenced by the soil. The barnyard manure left a valuable residue on the clay soil and but an unimportant one on the light soil.

The results of experiments on the improvement of poor grass land show that on a clay soil from 5 to 10 cwt. of basic slag per acre is the most profitable application. Potash and lime did not prove profitable. The use of nitrogenous manures in conjunction with phosphates when beginning to improve poor clay soils is not recommended.

A fertilizer experiment with alfalfa showed that on clay soils this crop responds freely to phosphatic manures, remaining indifferent to dressings containing potash, while on sandy soils the potash manures are very effective and phosphates may fail to show improvement.

Variety tests of wheat, oats, and potatoes, G. C. Watson and N. G. Miller (*Pennsylvania Sta. Bul. 76, pp. 13*).—The yields of varieties most productive at the station since 1887 are reported.

Of 20 varieties of winter wheat 9 yielded over 31 bushels per acre. The 3 leading varieties, Harvest King, Martin Amber, and Royal Red Clawson, yielded 34.60, 34.58, and 34.22 bu., respectively. The average yield of all varieties was 29.17 bu. per acre. The average of the 13 smooth varieties was 28.86 bu., and that of the 7 bearded varieties 29.74 bu. Dietz Longberry Red and Reliable gave the heaviest weight of grain per bushel, 61.25 lbs. Of the varieties tested for 15 years Fulcaster stands in the lead with 31.13 bu. of grain and 3,821 lbs. of straw per acre.

The 19 varieties of oats grown in 1905 gave an average yield of 56.09 bu. per acre, the range being from 47.80 to 61.50 bu. Czar of Russia ranked first in the production of grain, and Mortgage Lifter, which stood last in grain production, ranked first in yield of straw. In 1904 White Russian was the leading variety, with 77 bu. of grain per acre, while Czar of Russia yielded only 69.13 bu. The yield of White Russian in 1905 was 56.93 bu. per acre.

Forty-three varieties of potatoes were grown this season and an average yield of 187 bu. per acre was secured, but of this quantity 27.4 bu. were unmerchantable tubers. The leading varieties, mentioned in decreasing order of yield, were Eureka, Heath Medium Late Beauty, Uncle Sam, Early Rose, Early Puritan, Extra Early Crusader, Irish Daisy, Early Nancy, and Bliss Triumph, all producing over 200 bu. of merchantable tubers per acre, while the remaining varieties fell below this yield. The average total yield for all the varieties for 1904 was 77.9 bu. more than the yield for 1905.

Crops of southern France, Algeria, and Tunis, C. Rivière and H. Lecq (*Cultures du midi de l'Algérie et de la Tunisie. Paris: J. B. Baillière & Son, 1906, pp. XII + 511, figs. 69*).—This book discusses the culture of tropical and subtropical crops grown in southern France and in northern Africa. The topics discussed are climate, cereal and garden crops, viticulture, forage crops, forestry, fruits, ornamentals, plants furnishing rubber, tannin, dyes, fibers, perfume, starch, oil, etc., and the marketing of fruits and legumes.

Clark method of growing grass for hay, C. D. Woods and J. M. Bartlett (*Maine Sta. Bul. 126, pp. 25-28*).—About 2 acres of land was treated as nearly as possible in accordance with the Clark method.

The results indicated the value of thorough preparation of the seed bed and liberal applications of fertilizer in grass growing. The grass was sown in the fall of 1904 and in July of the next year 6¼ tons of field-cured hay was harvested. This crop cost about $40 for fertilizers and about $37 for labor and seed. The station does not believe this method adapted to Maine, as it does not fit in with mixed farming and rotation of crops, and further, because the seeding formula recommended does not contain clover.

Report on an experiment conducted at Cransley, Northamptonshire, in seasons 1901, 1902, and 1903: The improvement of poor pastures, T. H. Middleton (*Cambridge Univ., Dept. Agr., 1904, pp. 35, dgms. 2*).—The results of cooperative work indicated that to improve poor pastures on clay soils it is advisable to begin with the use of from 7 to 10 cwt. of basic slag per acre. Barnyard manure, sulphate of ammonia, or dissolved bone should not be used in the beginning, but may be applied after the first few years are over. The improvement of soil by clovers and the management of pastures is discussed.

Range improvement, J. J. Thornber (*Arizona Sta. Rpt. 1905, pp. 17-21*).—The range improvement work of the station for the year ending June 30, 1905, with the weather conditions for the period, is briefly reviewed.

A good growth of forage plants on the range reserve is reported, and the prevailing species are enumerated. Two common species of Indian wheat made the best growth, the average height being 10 in. In estimating the relative amount of spring forage on the mesas on small plats from which the plants were pulled up by the roots, dried, and weighed, it was found that the average yield was at the rate of 2,812 lbs. of forage to the acre.

Notes are given on cultural operations, the continuation of work upon the economic cacti, the forage garden, and on the viability of native grass seeds. The different species of forage plants sown on the range reserve and the percentage of germination as determined for a large number of native grasses are enumerated.

Alfalfa, T. F. HUNT ET AL. (*New York Cornell Sta. Bul. 237, pp. 139–177, figs. 10*).—This bulletin is a report of progress on cooperative tests with alfalfa in several parts of the State and of field tests on the college farm. An outline of cooperative demonstrations in the different branches of agriculture to be made in 1906 is appended.

The location and description of soils suited to alfalfa culture in the State are given, and the results of experiments with the crop are discussed. In 63 per cent of the cooperative tests in districts where alfalfa growing is not yet established no nodules at all were found on the plants. During 2 seasons' work with alfalfa bacteria transported by the cotton method, only one case gave an increase of vigor in the plants, while the method of inoculating by the use of soil from an old alfalfa field uniformly resulted in an abundance of nodules.

Dressings of lime usually proved beneficial, and on the heavier soil of the college farm it was found essential to the crop. The use of 2,000 lbs. per acre produced somewhat better results than 1,000 lbs. and practically as good as 3,000 lbs. The results on the heavy soils indicated that the best success is to be obtained by a combination of lime, stable manure, and inoculation by means of soil from an old alfalfa field. On gravelly loam soil alfalfa without a nurse crop grew much stronger before winter set in than that grown with a nurse crop, but this superiority was not maintained in the season's production. During 3 months' storage thoroughly field-cured alfalfa hay lost between 15 and 16 per cent in weight.

Cooperative experiments with alfalfa, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 126, pp. 35–41*).—Cooperative culture tests with alfalfa in 1904–5 are described and directions given for the culture of the crop. The results thus far secured do not show conclusively that in general alfalfa can be successfully grown in Maine.

Alfalfa and red clover, J. W. WILSON and H. G. SKINNER (*South Dakota Sta. Bul. 94, pp. 16, fig. 1*).—The results of 3 years' experiments with alfalfa and clover at the station and in the forage tests at Highmore are presented.

In the spring of 1904 native sod on the college farm was disked 5 times and part sowed to alfalfa and part to clover, but only the clover made a fair stand. At Highmore a field of Turkestan alfalfa sowed in 1899 still produces good yields. Satisfactory results have been obtained with both the Turkestan and the American varieties. In 1902 a field foul with mustard was sown to alfalfa, with the result that the following year the mustard was practically killed out and a first-class stand of alfalfa was secured.

At the station Turkestan alfalfa sowed May 10, 1903, yielded 5,437 lbs. of hay per acre from 2 cuttings in 1904 and 5,113 lbs. from 2 cuttings in 1905. Montana-grown seed sowed in May, 1903, gave a total yield from 2 cuttings of 5,733 lbs. the following season. The experience in alfalfa culture by farmers throughout the State is briefly noted.

Clover was successfully grown on thoroughly disked native prairie and *Bromus inermis* sod. The seed was sown at the rate of 10 to 12 lbs. per acre and perfect stands were secured. A clover field 1 year old gave a total yield of 5,484 lbs. of hay per acre as compared with 3,294 lbs. on a sod-bound *Bromus inermis* field. In another field a total yield of 9,358 lbs. of hay per acre was secured from clover and only 2,360 lbs. from *Bromus inermis*.

Culture of the fodder beet in Tunis, R. GAGEY (*Bul. Dir. Agr. et Com.* [*Tunis*], *9 (1905), No. 37, pp. 554–560*).—The results of culture experiments with fodder beets are shown in tables.

In selecting a variety or choosing the distance between plants it is recommended that the total quantity of dry matter produced per hectare be taken into account and

not only the percentage. It was found that subsoiling for fodder beets increases the average weight and size of the roots, gives much larger total yields, and decreases the density and the percentage of dry matter, the beets being larger and containing more water. Although the percentage of dry matter is lowered, the total yield is generally increased, especially in dry years. A considerable increase in yield of beets was also secured by irrigation.

Corn culture, R. J. Redding (*Georgia Sta. Bul. 69, pp. 41–60*).—Twenty varieties of corn tested in 1905 gave an average yield of 38 bu. per acre. The leading varieties, Albemarle and Marlboro, yielded 47.36 and 46.20 bu. per acre, respectively.

Residual effects of fertilizers applied to cotton in 1904 were not apparent in the corn crop of 1905. The plants fertilized this year yielded an average of 30.24 bu and those not fertilized since 1904, 25.82 bu. per acre. This increase of 4.44 bu. from the use of fertilizers was secured at a cost of 80 cts. per bushel. A second fertilizer test gave similar results and it is concluded that the use of commercial fertilizers is not a reliable means to permanently increase the productiveness of soils.

Applying one-half of the quantity of cotton-seed meal at planting and one-half on May 19 was found inexpedient. Substituting the equivalent in nitrate of soda for one-half the quantity of cotton-seed meal did not prove profitable. As in previous years, cotton-seed meal was more effective than cotton seed applied directly to corn.

Corn improvement, J. A. Jeffery (*Michigan Sta. Spec. Bul. 34, pp. 23, figs. 15*).—This bulletin is a popular discussion on the improvement of corn by a more careful selection of seed and better cultivation. Directions are given for the selection, storing, and testing of seed corn, and the different cultural operations connected with growing the corn crop. Cross breeding corn for the improvement of quality and the fixation of character are discussed and outlines for judging or scoring corn are given.

Experiment with corn, G. A. Crosthwait (*Idaho Sta. Rpt. 1905, pp. 33–35*) —In 1904 26 varieties secured from various sources were tested and the earliest ears selected for seed. Seed was saved from 9 dent and 2 flint varieties. Only a few ears were secured from each variety making seed, and 5 of those saved were from seed grown near Moscow. In 1905 over 50 varieties were tested and seed selection was made with reference to earliness.

The germination of seed corn, J. W. T. Duvel (*U. S. Dept. Agr., Farmers' Bul. 253, pp. 16, figs. 4*).—The value of making germination tests is pointed out and complete directions for carrying on the work are given. Percentages of germination of seed corn as determined in individual ear tests of 10 kernels each from the crop of 1905 are shown in tables.

Of 67 lots of corn secured from various sources in different States 60 showed an average germination of less than 95 per cent, 48 of less than 90 per cent, and 10 of less than 80 per cent. The average germination of all ears tested was 86 3 per cent. The poorest lot contained only 2 good ears in 50, with 16 dead ears and an average germination of 39.4 per cent. The best 2 lots germinated 97.8 and 97.3 per cent, respectively, the first lot having 41 good ears in 50 and the second 42 in a possible 49. Of the 3,322 ears tested 1,416 germinated 100 per cent. The average germination of the remaining 1906 ears was only 77.7 per cent. This shows a gain of 13.7 per cent by discarding ears of low vitality.

Experiments with cotton and corn in 1905, J. F. Duggar and J. M. Richeson (*Alabama Canebrake Sta. Bul. 23, pp. 29*).—Among the varieties of cotton grown, Russell and Woodfin gave the largest yields on bottom lands and Woodfin and Peterkin on poor upland. On bottom land Russell produced a crop valued at $55.56 per acre for lint and seed. On poor red upland the value of the crop of Woodfin, the leading variety, was $18.31 per acre in lint and seed, with lint at 11 cts. per pound and seed at 70 cts. per 100 lbs. Subsoiling for cotton which was done when the subsoil was too wet gave unfavorable results. In 2 tests plowing 6½ in. deep resulted in the largest crop, but in 2 other tests no advantage from deep plowing was derived.

The yields of corn were but slightly affected by the method of preparing the soil or planting the crop. Plowing under Egyptian clover and subsequently a crop of cowpeas increased the succeeding corn crop 9 bu. per acre. Corn stover, cotton-seed hulls, or tasseling corn plants plowed under showed no very marked advantage, but the benefits from successive applications of cotton-seed hulls and corn stover became greater each year. Tests made on prairie soils showed that vegetable matter rich in nitrogen, such as is afforded by barnyard manure, sweet clover, and cowpeas, is needed for their improvement.

On poor reddish prairie soils both acid phosphate and cotton-seed meal increased the yield of cotton quite profitably, the increase being 66 lbs. of lint per acre with the phosphate and 40 lbs. of lint with the cotton-seed meal. Kainit was found useless in this fertilizer experiment with cotton. Nitrate of soda, cotton seed, cotton-seed meal, and cow manure, at the rate of 44, 434, 100, and 2,704 lbs. per acre, respectively, used separately, were found profitable for cotton on all grades of prairie land. Acid phosphate did not give decisive results on black slough land but on poor reddish prairie soil this substance and slag phosphate were both found highly profitable. On gray prairie land in good condition the use of 800 lbs. of a complete home-mixed fertilizer, or 8 to 10 tons of barnyard manure gave good returns. Acid phosphate and cotton-seed meal were both more effective when applied before planting. The nitrate of soda gave good results when applied at the first or second cultivation of cotton. Manure from cattle fed on cotton-seed meal and hulls, applied in a small amount in the drill in both cotton and corn culture, increased the yield for each ton of manure about 18 per cent in the first crop after the application, 15 per cent in the second, and 9 per cent in the third, the increase aggregating in value in the 3 years from $4.47 to $11.94 per ton of manure.

Fertilizer applications for cotton and oats are suggested.

Cotton culture, R. J. Redding (*Georgia Sta. Bul. 70, pp. 61–90*).—This bulletin is the report for 1905 on cotton experiments in progress at the station (E. S. R., 16, p. 866).

In the variety test of this year Cook Improved, which ranked first among 30 varieties in total value of crop produced, also stood first in earliness. The value of lint and seed produced by the different sorts ranged from $44.68 to $66.11 per acre. Cook Improved produced 533 lbs. of lint per acre and 880 lbs. of seed, and the next ranking variety, Brown No. 1, yielded 488 lbs. of lint and 767 lbs. of seed. These two sorts were followed by Layton Improved, Moss Improved, Southern Wonder, and Toole Improved, mentioned in the decreasing order of total value produced, and all yielding over $57 worth per acre of lint and seed. The average height of the varieties grown was 3.67 ft., the range being from 3.23 ft. for Jones Re-Improved to 4.18 ft. for Lewis Prize. Moss Improved was the latest maturing variety. The best half of the varieties tested showed a tendency to produce a higher percentage of lint, a somewhat heavier boll, smaller seeds, and earlier maturing plants than the less productive half.

The results of 3 years' fertilizer experiments indicate that when nitrogen is given in the form of cotton-seed meal the best yields are obtained by making the entire application before planting. Such an application bedded on about 2 weeks previous to planting was found to induce early fruiting. From 16 to 20 lbs. of nitrate of soda per acre, applied in the furrow with the seed, has given good returns at the station. Substituting for one-half the quantity of cotton-seed meal its equivalent in nitrate of soda and applying the same as late as June 26 proved profitable. In the experience of the station growing cotton and corn simultaneously on the same ground can not be recommended.

The Mallory plan of preparing land for cotton showed no advantages over the ordinary method. The Mallory plan consists in throwing furrows 8 in. deep at half the distance apart of the intended cotton rows, and running deep subsoil furrows

within the furrows so made. This is done in the fall and the following spring alternate furrows are reopened with a shovel plow and the planting and application of fertilizers performed in the usual way.

A comparison of Peruvian guanos with home mixtures for cotton indicated that the same amounts of available phosphoric acid, nitrogen, and potash in the guanos were of equal value with the same elements in the forms of acid phosphate, cotton-seed meal, and muriate of potash. The results of an experiment with cotton-seed meal and crushed cotton seed, indicated that for fertilizing cotton 865 lbs. of cotton-seed meal is the fertilizing equivalent of 2,000 lbs. of crushed cotton seed.

Suggestions and formulas for the use of fertilizers in cotton culture are appended.

Cotton in Egypt, H. Lecomte (*Le coton en Égypte. Paris: A. Challamel, 1905, pp. 162, figs. 28, map 1*).—In discussing the present condition of the cotton industry of Egypt, this book devotes a chapter each to general cotton statistics, the soil, climate, varieties, variations, cultural operations, harvesting and ginning, soil exhaustion and fertilization, the distribution of cotton culture in Egypt together with the production and exportation of the country, and the culture of the crop in the Nile region under irrigation.

Hardy Bermuda grass, J. Fields (*Oklahoma Sta. Bul. 70, pp. 8*).—Experiments at the station have shown that Bermuda grass should be propagated only from the roots and pieces of sod of a sort that has survived severe winters in Oklahoma. The hardy strain growing at the station and elsewhere in Oklahoma quite generally survived the winter of 1905–6. Directions for planting Bermuda sod and its care after planting are given.

Two and one-half acres of thin upland soil were set to Bermuda grass on June 29 and 30, 1905, by sod planting, and on September 25 a yield of 2,584 lbs. of cured hay per acre, free from weeds and crab grass, was secured. The rainfall during this period amounted to 14.13 in. as compared with an average precipitation of 9.62 in. for the same period in previous years. An analysis of this hay made by the station chemist showed that it contained 9.70 per cent of protein and 1.24 per cent of fat.

The preservation and storage of hops, K. von Baur-Breitenfeld (*Pure Products, 2 (1906), No. 3, pp. 145–150*).—Investigations on the storing of hops indicated that hops should be stored in the hop chambers only when perfectly dry and ripe for bagging, and that sulphuring maintains the quality during storage.

The storage rooms should be kept at an even low temperature and perfectly dry. Temperatures from zero to 2 or 3° R. preserve hops better than higher temperatures because they reduce the moisture in the air to a greater extent and retard the oxidation of the hop resin and oil. The lower temperatures also better preserve the flavor of the hops. Hop chambers with direct refrigeration and stagnant air are as effective as those cooled by circulating cold air.

The potato crop, T. H. Middleton (*Cambridge Univ., Dept. Agr. Farmers' Bul. 3, pp. 54*).—Variety tests were conducted in 1903 and 1904 on a light loam soil. The best yields were secured from Dobbie Factor and Findlay Royal Kidney. Sutton Discovery and Findlay Evergood proved the most resistant to disease.

The sprouting of seeds before planting did not appear very useful for ordinary purposes. Planting entire tubers gave better results than the use of cut seed pieces. Tubers weighing 9 or 10 to the pound, or 1½ to 1⅝ in. in size, were most suitable for planting. Seed imported from Scotland produced equally good crops the first and second years, while the third year the crop was much reduced. The second growth induced by weather conditions in 1904 had a very injurious effect on the cooking quality of the potatoes.

The best results on poor light land were secured with a fertilizer application consisting of 1¾ cwt. of sulphate of ammonia, 3½ cwt. of superphosphate, and 1½ cwt. of sulphate of potash. On a light loam soil the best yield was secured where this same application of commercial fertilizers, together with 12 tons of barnyard manure per acre, was used. The barnyard manure alone also gave good results.

Report on experiments with potatoes, 1905, W. BRUCE and J. PORTER (*Edinb. and East of Scot. Col. Agr. Bul. 9, pp. 25, dgm. 1*).—Among 13 varieties of potatoes tested the second time Factor, Pink Blossom, and Up-to-Date were the only ones which yielded a heavy crop of fair quality. Of the medium early varieties King Edward VII was the most productive, being followed by White Blossom and British Queen. Some of the old standard varieties proved of equal value with the best of the new ones.

Sprouting the seed potatoes in boxes before planting increased the yield as well as the size of the tubers. Sprouted seed planted May 5 produced a better crop than unsprouted seed planted April 14.

On sandy soil the use of commercial fertilizers with barnyard manure was profitable, and on one of the test plats a complete commercial fertilizer gave better results than incomplete applications, although sulphate of potash alone gave a satisfactory return. Sulphate of ammonia gave a larger increase in yield than nitrate of soda. For sandy loams the use of 1 cwt. of sulphate of ammonia, 3 cwt. of superphosphate, and 1½ cwt. of sulphate of potash, given with a medium dressing of barnyard manure, is recommended.

Trial of varieties of potatoes, G. E. ADAMS (*Rhode Island Sta. Bul. 111, pp. 61–74*).—The fertilizer formulas used during a period of 7 years in potato experiments are given and the average yields of varieties for the number of years grown are shown in tables.

The range in yield of the 85 varieties under test was from 426 bu. per acre, the 3-year average of the Great Eastern, to 67.7 bu. per acre, the 2-year average of Rival. The total crop of Astonisher, Gem of Aroostook, and Prof. Dr. Maercker showed a maximum variation of only 0.9 of a bushel, yet in the percentage of merchantable tubers there was a variation of 26.4 per cent of the entire crop. A similar relation was observed between Commercial, Early Maine, and German Early Rose, the difference in yield of merchantable tubers in these 3 varieties being equal to 49.9 bu. per acre. In observing the disease resistance of varieties Prof. Julius Kühn showed the greatest immunity from injury by the blights. The selection of early-maturing varieties is considered as apparently the only safe plan to be followed to keep the crop free from blight.

Potatoes were sprayed 4 and 5 times during the season. Sixteen varieties gave an increased yield of over 50 per cent of the total crop as due to the additional spraying. Fifteen varieties showed an increase of from 25 to 50 per cent, 12 yielded from 1 to 25 per cent greater crops, while 8 varieties showed an apparent loss from the last spraying. The plants of the 15 varieties giving the greatest increase in yield remained vigorous and continued to grow from 2 to 3 weeks longer upon the area sprayed 5 times than upon the area sprayed only 4 times. Peerless Junior, State of Maine, Burbank, White Star, and Vermont Golden Coin, sprayed 5 times, retained from 90 to 100 per cent of their foliage for more than 3 weeks after the plants sprayed only 4 times were dead.

Home-mixed fertilizers for potatoes, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 126, pp. 41–44*).—The details of experiments here reported have been previously noted (E. S. R., 16, p. 1073). In 1905 three home-mixed fertilizers were compared with one commercial potato fertilizer and the results, on the whole, were lower with the home-mixed than with the commercial fertilizer. The results are considered as not admitting of conclusive interpretation at the present time.

Ramie and similar crops in India, G. B. DE CARDO (*La ramie et ses analogues aux Indes Anglaises. Paris: A. Challamel, 1906, pp. 123*).—This book is a translation and a résumé of information on the culture and preparation of ramie and other analogous fiber plants in India. The information here given is taken from the Dictionary of the Economic Products of India, by G. Watt, published from 1889 to 1893.

Field observations upon the tolerance of the sugar beet for alkali, G. W. SHAW (*California Sta. Bul. 169, pp. 29, figs. 20*).—Previous work along this line,

described in earlier publications of the station (E. S. R., 8, p. 683; 12, p. 942), is briefly summarized. The later observations here recorded were made by the author at Grand Junction, Colo., in 1900 and at Oxnard, Cal., in 1904.

The investigations in Colorado indicated that in the virgin soils under test the heavy percentage of alkali lies above the fourth foot, and that the excessive amounts found in the upper foot have been brought there from that depth by shallow irrigation and by the upward leaching of the soil due to seepage. The average of 8 soluble salt determinations upon soils producing either good or fair crops of beets shows a percentage of 0.036 of chlorids, 0.004 of carbonates, and 0.087 of sulphates, or a total of 0.127 per cent in the upper foot of these fields. These figures correspond to 1,440 lbs. of chlorids, 160 lbs. of carbonates, and 3,480 lbs. of sulphates, or a total of 5,080 lbs. of soluble salts in the upper acre-foot. The yields of beets ranged from 7.76 tons to 20.98 tons, or an average of 8.45 tons per acre, with an average sugar content of 16.03 per cent and a purity of 81.8.

Soils producing poor crops of beets under the same conditions of cultivation and treatment were found to carry much more chlorid in the top foot than was held in the upper 3 ft. of the soils producing fair crops. These data are regarded as showing that the soluble salt content of the soil is the primary cause of the failure of beets, but it is pointed out that the high percentage of alkali is not uniform throughout the locality, and that by proper selection of soils these difficulties may be avoided.

The strength of the soil solution was determined as based on 20 and 10 per cent of moisture in the soil. It was found that the heavy adobe soil 2 days after irrigation contained from 18 to 20 per cent of water, while several days after irrigation the moisture content had fallen from 8 to 12 per cent and the plants were suffering from lack of water. As shown by the analyses made, the solution in soil with 20 per cent of moisture contained 2.97 per cent of alkali, and with 10 per cent of water in the soil 5.86 per cent. It is pointed out that when the density of a soil solution becomes too great the vitality of the seed is destroyed or, in the case of already growing plants, the passage of water from the soil into the plant is checked.

At Oxnard, Cal., observations were made in fields with a marked unevenness of stand, which frequently characterizes beet fields on alkali soils. The results on all the different fields pointed to the fact that wherever the chlorid content of the soil approached 0.20 per cent beet culture was unsuccessful. It was further shown that the sulphates had a comparatively limited effect on the growth of beets. The effect of the different salts is more clearly brought out in the following table:

The effect of different percentages of soluble salts on the growth of sugar beets.

Condition of beets.	Sulphates.	Carbonates.	Chlorids.	Total salts.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
No growth	0.4063	0.0092	0.1957	0.6112
Poor	.3602	.0000	.0742	.4344
Fair	.2010	.0044	.0746	.2800
Good	.2629	.0101	.0419	.3149

On this particular field the sugar content of the beets ranged approximately from 17 to 22 per cent.

In certain portions of these fields where good beets were produced, practically all the alkali was found in the top foot of soil, where it could have little or no effect on the more delicate feeding roots of the plant, while on adjacent spots producing no beets the concentration of the alkali was essentially the same in the first and the second foot of soil, bringing it within reach of the fibrous-feeding roots. These results are regarded as indicating that the distribution of the soluble salts within the soil may be a more important factor than the total quantity of alkali present, and

also as explaining why beets fail to grow in certain places although little or no alkali appears near the surface. The failure of plants, even though the seed germinated well and a good stand was originally obtained, is also accounted for by this fact. In these observations fair beets were found growing in soil with an average of 4,000 lbs. of chlorids per acre-foot, and it was noticed that certain individuals have a much greater resistance to alkali than others. It is believed that the success of beet culture in regions with alkali soils depends upon the proper soil selection and the development of a more alkali-resistant beet.

Sugar beets in the San Joaquin Valley, G. W. SHAW (*California Sta. Bul. 176, pp. 27, figs. 11*).—The results of field observations and analyses connected therewith since 1902 are reported.

In 1902 the average results of 9 tests showed a sugar content in the beet of 14.9 per cent and a purity of 83.5, but the average yield was only 4.74 tons per acre. These figures are regarded as showing that the general climate and soil conditions are suitable for the production of high-class sugar beets. The low tonnage was largely due to late planting. A satisfactory yield can be obtained only by early planting, which will allow the plants to make considerable growth before the hot weather of the summer months.

These conclusions were confirmed by results obtained in 1905. It is also stated that, in general, the results will be very unsatisfactory when the beets are grown without irrigation. The failure of the plantings of 1905 was primarily due to late planting and inadequate irrigation, and in a lesser extent to poor soil preparation, poor cultivation, and beet blight. General discussions on the climatic conditions, moisture and sunshine requirements, and on soils and their preparation and cultivation are given, and the results of earlier experiments conducted by the station with sugar beets in southern California are reviewed in an appendix.

Manurial experiments with sugar cane in the Leeward Islands, 1904–5, D. MORRIS (*Imp. Dept. Agr. West Indies, Pamphlet 39, 1906, pp. 51*).—A summary of the results with seedling and other canes at the experiment stations in the Leeward Islands is given.

At Antigua the results showed that the canes B. 156, Sealy Seedling, B. 306, B. 208, D. 74, D. 95, and D. 109 are specially worthy of attention. The ratoons of 6 of these canes also ranked first at the various stations. In St. Kitt's Caledonian Queen and White Transparent gave the best results, while the Barbados seedling canes B. 208 and B. 147 were also satisfactory. The ratoon crop of B. 208 ranked first with a yield of 30 tons of cane and 8,508 lbs. of sugar per acre in the juice.

Relating to the sugar industry in Peru, T. F. SEDGWICK (*Trujillo, Peru: Haya, Verjel & Co., 1905, pp. 78, pls. 11, charts 3*).—This book contains descriptions of the sugar districts and sugar estates in Peru and a review of the methods of sugar-cane culture in that country, together with a brief discussion on the manufacture of cane sugar and the utilization of by-products. Comparative data from different sugar-growing countries are also given. Special reference is made in this work to the sugar estate known as Hacienda Cartavio.

Germination of seeds as affected by nutrient salt solutions, O. KAMBERSKY (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 1, pp. 33–43*).—Work along this line by several investigators is reviewed, and results of experiments at the seed control station at Troppau are reported.

Of each of 15 different field crops 400 seeds were soaked for 48 hours in a solution of a mixture of ammonium and potassium nitrate and sodium and ammonium phosphate. For the purpose of a check test the same number of seeds of each crop were soaked in water for the same length of time. When these samples were subjected to a germination test the seeds soaked in the nutrient salt solution did not sprout so quickly and, with the exception of sugar-beet seed, did not show as high a percentage of germination as the seed soaked in water.

The various crops showed different degrees of resistance, which is believed to be partly due to the age of the seed, although it was observable in fresh seed with a weakened vitality. All degrees of vitality were represented in each individual sample, and it is concluded that the weakest seeds lost their power to germinate when soaked in the salt solution, while in the resistant seeds the germination was delayed. It was also found that the parts of the embryo were differently affected, the plumule appearing more resistant than the radicle. Seeds of grains taken from the germinating chamber and transferred to fresh soil continued their growth normally, but were retarded as compared with seeds not treated with the salt solution.

Seed inspection, C. D. Woods and Bessie G. Tower (*Maine Sta. Bul. 125, pp. 26*).—This bulletin contains the text of the Maine laws regulating the sale of seeds, and the results of analyses of samples of seeds collected by the station in 1905 and received from correspondents from 1902 to 1905. A list of weed seeds from the samples tested is given and attention is called to the free analysis of weeds, seeds, fertilizers, and feeds by the station.

HORTICULTURE.

Department of agriculture and horticulture, V. A. Clark (*Arizona Sta. Rpt. 1905, pp. 10-15*).—Attention is called to the intense heat and light in Arizona and the effect of these on plant growth. Shading has been found a specific for many crops which are injured or even killed in the open. Where the summer heat raises the surface soil to so high a temperature as to interfere with root growth mulching has been found a specific remedy. Deep planting of trees has also been practiced successfully to overcome this trouble.

The results secured at the station with a number of fruits and vegetables during the season are briefly stated. Guavas have been successfully grown, both in the open and in shade, and withstand a temperature of 19° F. The McNeal variety of garden pea was less injured by frost than the American Wonder variety. A study is being made of varieties of olives in Arizona. No insect nor fungus pest has been found as yet to attack this crop.

Some alfalfas from Sahara and Arabia promise to surpass the strain commonly raised at the station in growth during the hot months. The yields of 3 varieties of durum wheats in comparison with the Sonora variety are given. In every case the yield was considerably higher, and the straw, though taller, showed less tendency to lodge. It also rusted much less. Pea plants from light-weight seed died as a result of weather conditions a number of days earlier than from heavy seed. It is believed that considerable valuable work can be done along the line of seed selection.

Report of the horticultural department, J. Troop (*Indiana Sta. Rpt. 1905, pp. 19-21*).—An outline of the experimental work of the department during the year, with some of the chief results obtained. In the use of pedigreed strawberry plants the results of a single season's work indicate clearly that "the pedigree theory as applied to strawberry plants has been overdone."

In some fertilizer experiments with tomatoes great differences in the productiveness of individual vines, due to individuality, were observed. In spraying experiments it is found just as essential to spray for the second brood of codling moth as for the first brood. San José scale has been found in 44 counties of the State. A new aphid was discovered during the summer of 1904, which seems to be especially partial to Houghton gooseberry bushes. The aphid is briefly described and has been given the name of *Aphis houghtonensis*.

Fruits and vegetables, E. B. Ferris (*Mississippi Sta. Bul. 87, pp. 2-7*).—An account is given of the commercial culture and marketing of a number of varieties of fruits and vegetables, including potatoes.

The best results with strawberries have been secured with the Klondyke variety. The most effective fertilizer was a mixture made up of 200 lbs. of cotton-seed meal, 400 lbs. of acid phosphate, and 100 lbs. of kainit. The yield with this fertilizer was at the rate of 191.6 crates per acre. These results with berries, as with all the other crops experimented with, showed that the soil is lacking in phosphoric acid. On account of the scarcity of labor and poor shipping conditions the northern limit of successful marketing was Birmingham and Chattanooga. The best shipping package was a 24-qt. ventilated crate. The returns from 275 24-qt. cases netted a little less than $500.

Asparagus was marketed most profitably in Chicago. Twenty ½-bu. boxes gave a net return of $30. When commercial fertilizers were used on cabbage, the increase over unfertilized plats was 223 per cent, and 299 per cent on soil that had been parked with cattle. The normal fertilizer used on this crop was 430 lbs. of cotton-seed meal, 420 lbs. of acid phosphate, and 200 lbs. of kainit. When either the cotton-seed meal or acid phosphate was decreased the crop was lessened, but when the kainit was decreased the yield remained practically the same.

Wardwell Kidney Wax beans averaged 120.8 bu. per acre, and Improved Valentine 121.6 bu., counting 30 lbs. to the bushel. The use of kainit was without effect in increasing the yield of this crop, but both nitrogenous fertilizers and phosphates gave marked increased yields. The unfertilized soil yielded 66 bu. per acre. When fertilized with a mixture containing 209 lbs. of cotton-seed meal, 114 lbs. of dried blood, 455 lbs. of acid phosphate, and 213 lbs. of kainit the yield was 150 bu. per acre. One-half of this fertilizer mixture gave a yield of 121.5 bu. per acre. When the nitrogen was left out of the mixture the yield was 82 bu. per acre. Acid phosphate alone produced a yield of 104.5 bu. per acre. The net returns from shipping 2 acres of beans to northern markets was $173.29. The bushel hamper was a much more desirable package for this crop than the bushel box.

Burbank was the heaviest yielding variety of potato grown, producing 182.5 bu. per acre. Native seed produced but 70.6 bu. per acre, while with at least 5 varieties from other sources the yield was in no instance less than 126.8 bu. per acre. The net returns from 2 acres of potatoes were $112.

A test was made with different sized seed pieces, varying from 1 eye to whole medium sized tubers. The yield with one-eye pieces was 68.9 bu. per acre, and this was gradually increased to 107.9 bu. when whole potatoes the size of a guinea egg were used. Among other vegetables grown were onions, beets, radishes, kohl-rabi, turnips, ruta-bagas, eggplants, and peppers. The only ones profitably marketed were beets, ruta-bagas, and turnips.

Further studies in lettuce culture, W. STUART (*Vermont Sta. Rpt. 1905, pp. 292–296, pl. 1*).—In an earlier report (E. S. R., 17, p. 249), an account was given of an experiment to determine the comparative value of different forms of chemical fertilizers, the relative value of chemical fertilizers and rotted manure, and the relative influence of surface *v.* subwatering for lettuce. In the present instance a report is made on flat-grown *v.* bench-grown plants; and combination indoor and outdoor lettuce culture.

In the first experiment plants were grown in flats until ready for market. The flats were 12 by 16 by 3.5 in. One dozen plants were grown in each. Similar plants were grown in benches at a distance of 8 by 8 in. apart. The bottom of the flats was filled to a depth of 1.5 in. with well-rotted manure. Thirty-four square feet of space were given to each method of culture.

The plants in the flats were ready for market a week in advance of those in the bench. Their average weight was 86 gm., while those in the bench averaged 210 gm. each. The flat-grown plants presented a good appearance and sold for 40 cts. per dozen, while the bench-grown plants commanded but 50 cts. per dozen. From the

standpoint of space, therefore, the returns per square foot were 26 cts. from flat-grown plants and but 10 cts. from bench-grown plants.

The conclusion is drawn that for local market conditions a greater net profit can be made from lettuce planted in flats. The growing of the plants in flats to maturity considerably lessens the labor required, though the lettuce is not so heavy nor so good by close planting as when sufficient space is allowed for development.

In the combination indoor and outdoor lettuce culture, lettuce was started in the greenhouse and transplanted to the open as soon as weather conditions permitted. Good crops were thus secured. The average weight of the plants of a number of different varieties grown for 2 years is tabulated. Iceberg gave the heaviest yield in each of the 2 years. It is believed that seedlings could be grown equally as well in the hotbed as in the greenhouse for this work, and that in the vicinity of the station this method of culture would be very profitable.

Fertilizer experiments in field culture of garden peas (*Maine Sta. Bul. 126, pp. 30–34*).—Garden peas were grown for a cannery on 2 farms. Part of the peas grown was inoculated with pure cultures of nitrogen-fixing bacteria from the Department of Agriculture and from commercial sources. Commercial fertilizer was used on both farms. A severe drought seriously interfered with the experiment.

On one farm the soil was found to be thoroughly inoculated with the nitrogen-collecting bacteria, and the use of pure cultures was without additional benefit. On the other farm which, so far as known had never been planted to peas, some of the plants on the inoculated plats were found to contain tubercles on the roots, but no more than on some of the other plants which were not inoculated.

The cassaba melon (*Pacific Rural Press, 71 (1906), No. 10, p. 148*).—The history of this muskmelon, also known as Winter Pineapple Muskmelon, is given, with an account of its introduction into the United States, and the methods observed by the author in its culture. This is a late melon, suitable for Christmas use, and grown to some extent as a stock food.

Report of culture experiments in 1905 on the sewage fields of Berlin, J. KLAR and O. MENDE (*Gartenflora, 55 (1906), Nos. 2, pp. 35–40; 3, pp. 66–70*).—The results are given of tests in growing large numbers of flowers and vegetables, with brief comments on the various varieties.

Soil sterilization, W. STUART (*Vermont Sta. Rpt. 1905, pp. 297–299*).—A historical account is given of the development of soil sterilization by means of steam and otherwise in this country, with an account of the author's investigations in sterilizing soil in solid beds and subwatered benches.

"Three in. drain tiles were sunk about 10 in. below the surface of the soil. The lines of tile were laid every 16 in., each line being independent of the other and connected with the surface by a vertical section of draintile." When steam was properly connected and turned in the tile at a pressure of 40 to 60 lbs., a bed containing approximately 70 sq. ft. of surface could be heated up to about 210° F. in about 3 hours' time. When the surface soil was well covered with burlap, the heat was maintained at this temperature for a long time, and was entirely effective against nematodes. This method of soil sterilization involves less labor than the usual method of sterilizing in boxes, as there is no handling of soil and the draintiles are far enough below the surface to be out of the way of cultural operations.

A large portion of the bench surface in the greenhouse is fitted for subwatering by means of galvanized iron pans and layers of porous brick. An attempt was made to sterilize the soil in this bench by injecting steam into the pan through the watering tube. The result was unsatisfactory, as too much steam was required. Much of the steam condensed in coming in contact with the cold porous bricks, and it is believed that it would be more economical to employ a sterilization box in the treatment of soil in subwatered benches.

How to use a planting plan, I. G. TABOR (*Gard. Mag. [N. Y.], 3 (1906), No. 3, pp. 146, 147, chart 1*). A complete chart is given for planting a 50 by 100 ft. lot. The plan shows the kind of trees, shrubs, and flowers to plant, just where each one should be planted, and the method of transferring a planting plan to the ground.

Blossoming of fruit trees, L. B. JUDSON (*Idaho Sta. Rpt. 1905, pp. 23–32, charts 3*).—The blossoming season of a large number of varieties of apples in different parts of Idaho in 1904–5 are tabulated, as well as the blossoming season for 12 varieties of pears and 5 varieties of peaches for the season of 1905.

On the winter injury of apple trees, W. STUART (*Vermont Sta. Rpt. 1905, pp. 299, 300, pls. 2*).—A further note is given on the injury to apple trees during the winter of 1903–4, mentioned in an earlier report of the station (E. S. R., 17, p. 249). The winter-injured trees after blossoming and partially leafing out apparently stopped growth and the unfolded leaves shriveled and died. Later in the season many of the trees pushed out into new growth, usually at the base of the scaffold limbs, or somewhat higher up.

Experiments were undertaken to see if the trees would not be benefited by pruning. A number of eight-year-old Rhode Island Greenings were severely pruned back, others less vigorously handled, and some not pruned at all. It was thought that the severe pruning of the trees on which new growths were being pushed out at the base of the limbs would tend to throw the strength of the tree into a few branches, and thereby induce greater growth and a more shapely head. The orchard was not given good cultivation.

The growth made on the differently handled trees is shown in a series of illustrations. "A careful study of this series of photographs affords little evidence that pruning was beneficial." As a result of the investigations, the author recommends that pruning operations be deferred to the latter part of the growing season or the following spring, rather than immediately after such winter injury as noted in the experiment. Severe pruning is inadvisable.

Influence of stock on scion, W. STUART (*Vermont Sta. Rpt. 1905, pp. 300–305*).—In 1899, 5 classes of plums were root grafted on 4 types of stocks. The stocks used were Americana, Wayland, Marianna, and Peach, and the scions were Stoddard of the Americana group, Green Gage of the Domestica group, Chabot of the Japanese group, Milton of the Wild Goose group, and Newman of the Chicasaw group.

The results secured with this combination of stocks and varieties in Maryland have been previously noted (E. S. R., 14, p. 1069). The present report covers the results secured in Vermont from 1900 to 1905. Tabulated results given in the report show that 93 per cent of the varieties on Americana roots lived, 100 per cent on Wayland, 80 per cent on Marianna, and 40 per cent on Peach. The average diameter of the trunk of the trees produced on these different stocks is shown in the table below, the measurements being made at the collar and 1 ft. above the collar:

Trunk growth of varieties of plums on different stocks.

Variety of plum.	Americana.		Wayland.		Marianna.		Peach.	
	Collar.	Foot above.	Collar.	Foot above.	Collar.	Foot above.	Collar.	Foot above.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
Stoddard	2.00	1.75	1.69	1.32	1.69	1.44	....	....
Green Gage	2.38	2.19	2.72	2.56	2.69	2.50	2.50	2.31
Chabot	2.50	2.81	3.19	2.00	2.72	2.53	....	....
Milton	2.41	2.00	2.50	2.22	3.28	3.19	1.03	.88
Newman	3.03	2.69	3.16	2.97	3.03	2.97	2.88	2.75
Average	2.46	2.19	2.65	2.41	2.68	2.53	2.14	1.96

"These measurements show that Stoddard on Americana gives the greatest average diameter of the trunk, with Marianna and Wayland about equal. Green Gage did best on Wayland, with Marianna a close second, Peach and Americana being third and fourth, respectively. Chabot was best on Wayland and second best on Marianna. Milton was far superior on Marianna than on any other, Wayland and Americana occupying second and third places. Newman did well on all stocks, but was slightly superior, in diameter at least, on Wayland, followed by Marianna, Americana, and Peach in the order named. . . . Stated briefly, Americana seems best for Americana; Wayland for the Japanese; Milton for Marianna, with little choice between Wayland and Marianna for the Domestica group, and no marked choice between any of the four stocks for the Chicasaw group."

The influence of Wayland stock on Milton variety is given special mention. On Wayland the Milton grew more or less upright, while on Marianna the head was low, bushy, and spreading. The variety Newman made especially good growth on Peach roots, and it was suspected that roots might have been sent out by the scions. Some of the trees were dug up, but in only one instance was this found to be true, and this exception is not considered of any vital importance.

"A comparison of the root systems showed the Peach to be the deepest rooted and least spreading. Marianna and Wayland possessed numerous spreading and rather shallow lateral roots. Americana, while having a spreading lateral-root system, was not as symmetrically developed as were the two former. In none of them could the root system be said to be much superior to that of Peach stock." Milton on Marianna stock was much more seriously affected by "plum pocket" than when grown on Wayland or Americana. Whether it was due to stock or not could not be told.

Hybrids in their relation to grafting and wines (*Bul. Agr. Algérie et Tunisie, 11 (1905), Nos. 23, pp. 524–530; 24, pp. 550–557*).—The essential part of this article is an address delivered by L. Daniel before the Viticultural Society of Lyons, in which he reviews his work on grafting in the improvement of grapes, and points out its practical application.

It appears that the best French varieties of grapes can not be improved from the standpoint of the fruit by grafting, but may be improved from the standpoint of resistance. The case is different with hybrids, where opportunity for amelioration by grafting is much greater, since not only can the resistance to phylloxera be thus increased, but the crop greatly modified.

Variations produced by grafting seem often to be hereditary in the vine. It may thus happen that many old varieties may be materially modified in time. In order to avoid this, it is recommended that experimental vineyards be established in which the old French varieties of grapes, which have been originated with such great care, may be preserved in their purity.

Variation by grafting, G. BONNIER (*Fermes et Châteaux, 1 (1905), No. 4, pp. 6–8, figs. 5*).—A popular and somewhat extensive review of the work of L. Daniel on grafting between different species of plants, and on the hybrid variations obtained. The review covers the results of the grafting experiments noted more at length in earlier numbers of the *Record*.

Study of the cider apples of Sarthe, P. L. C. CASSARINI and E. POUPARD (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 2, pp. 157–179*).—A general account is given of the cider regions of Sarthe, and of the varieties of apples used in cider production. The various varieties are described in considerable detail, and a table given showing the vigor and hardiness of different varieties when grown on the various soils of different regions, the yields obtained, quality of fruit and cider made from it, with analyses of the ciders.

Olives and citrus fruits (*Louisiana Stas. Rpt. 1905, pp. 9, 10*).—During the year 1 variety of olive, Pensulina, produced fruit which was successfully pickled. The fruit is of fine flavor and medium size. It is believed that these are the first olives to be grown to maturity and pickled in Louisiana. Citrus hybrids produced by

this Department by crossing *Citrus trifoliata* with sweet oranges have withstood a temperature of 18° F., the coldest weather at the station since they were planted.

Varieties of dates of Tagant and Adrar, R. ARNAUD (*Bul. Agr. Algérie et Tunisie, 12 (1906), No. 3, pp. 60, 61*).—A list is given of the species of dates grown in these regions, the names being given in both French and Arabic, and comments added as to the usefulness of some of the varieties.

Tropical fruits on the Florida Keys, P. J. WEBSTER (*Fla. Agr., 33 (1906), No. 9, pp. 161, 162*).—An account of the methods of culture of the tropical fruits grown on the Florida Keys, including pineapples, avocado, mangoes, sapodillo, bananas, sugar apples, soursop, custard apples, eggfruit, papaw, pomegranate, etc.

Miscellaneous fruit notes, W. STUART (*Vermont Sta. Rpt. 1905, pp. 305–309*).—Tables are given showing the blossoming, leafing out, and ripening periods of plums and cherries for the years 1903 to 1905, inclusive. The data show a close relationship between the time of flowering and the time of fruiting. Recommendations as to the best varieties of plums and cherries are given.

Growing fall bearing strawberries, S. COOPER (*Amer. Agr., 77 (1906), No. 13, p. 429, fig. 1*).—The Pan-American and Autumn varieties of strawberries that bear fruit in the fall are described and methods given for their cultivation. In the case of the Pan-American variety it is stated that by judicious cultivation and systematic removal of the early blossom stems this variety will continue to bear until the green berries are frozen. An illustration is given of the plant in blossom and fruit.

The transportation of fruit in refrigeration, G. H. POWELL (*Cal. Fruit Grower, 33 (1906), Nos. 919, pp. 1, 3; 920, p. 5*).—A paper presented before the American Society of Refrigerating Engineers at its meeting in New York, December 4, 1905, in which the losses that occur in shipping perishable fruits in refrigerator cars are discussed.

Where fruits are shipped from the orchard without first cooling and are from 3 to 10 days in transit, large losses occur, particularly in the top tiers of fruit. The problem to be overcome is to secure refrigeration which will be sufficient to cool down all parts of the car sufficiently to prevent the development of decay, either by improved methods of car refrigeration or by cooling down the fruit before it is placed in the refrigerator car. Coupled with these requirements is the necessity of having the car refrigeration simple so that an ordinary brakeman could manipulate it satisfactorily.

The cocoanut and its relation to the production of cocoanut oil, H. S. WALKER (*Philippine Jour. Sci., 1 (1906), No. 1, pp. 58–81, pls. 10*).—This is a report of an extensive study of cocoanut production from the standpoint of quality and quantity of the oil yielded.

Analyses are given of the seashore and interior soils on which cocoanuts grew successfully, and of nuts picked at varying stages of ripeness, nuts from different localities, and nuts grown on both sandy soils and clay soils. It had been noticed that cocoanut trees growing near the seashore at San Ramon produced much more fruit than trees standing farther inland. Analyses showed the inland soils to be somewhat superior in the elements of fertility to the seashore soils, but were much less permeable.

The following table shows the fertilizing constituents contained in the husk, shell, meat, and milk of cocoanuts:

Analyses of cocoanuts.

Part.	Nitrogen.	Potash.	Phosphoric acid.
	Grams.	*Grams.*	*Grams.*
Husk	1.609	3.915	0.017
Shell	.660	.947	.459
Meat	4.683	2.475	1.740
Milk	1.542	1.313	.171
Total	8.494	8.650	2.387

It is calculated that 1 hectare of land on which 173 trees are growing will produce a total of 7,000 nuts per annum, and that each tree will lose annually 16 leaves, weighing about 3 kg. each. From these data it is calculated that the total annual drain on the soil per hectare from growing cocoanuts is as follows: Nitrogen, 91.12 kg.; potash, 135.37 kg ; and phosphoric acid, 41.38 kg. Based on these data and the analyses of seashore soil it is calculated that the seemingly barren seashore soils on which cocoanut trees are growing so vigorously contain sufficient nitrogen to produce crops for 307 years, sufficient potash for 1,478 years, and phosphoric acid for 677 years, not taking into account the probable inexhaustible supply of plant food constantly coming down in the seepage water from the interior hills. While irrigation and fertilizing may be of considerable value to trees in the interior, on the seashore irrigation would be of value only in dry seasons, and fertilizers would probably be washed away before they could be used by the trees.

The analyses of the nuts at different stages of growth are given in an extensive series of tables. They show that there is no indication of meat or fatty material in the nut until it has reached its maximum size and the shell is completed. With the formation of the shell the milk becomes rather sweet, and a slimy, pulpy mass, having a sweetish taste and comparatively little oil, begins to deposit on the inside, chiefly on the lower half of the nut. Gradually it extends over the whole of the inside of the nut, becoming denser and thicker and increasing in oil content at the expense of the sugar in the milk. This hardening process continues often in ripe nuts for 2 or 3 months after they have been picked from the tree, or until the nut sprouts.

With the appearance of the sprout the fat stored up in the nut is transformed into sugar and other bodies, and the embryo gradually increases in size until it occupies the whole space inside the nut and utilizes all the nourishment contained therein for its growth. In order, therefore, to secure the largest yield of copra and oil, only thoroughly ripe nuts should be used, and the author states that it is often advisable to allow these to stand in a dry place for a few weeks before they are opened. By the use of green nuts it is shown that there may be a loss of almost 50 per cent, while if nuts are stored for more than 3 months there is a loss due to germination, and often before that time nuts which have been cracked or bruised in gathering become rancid.

Analyses of different colored nuts—golden yellow and light green, both of which turn brown at maturity—show practically no difference in composition. The quality of nuts grown on the seashore, contrary to general statements, was not found to be superior to those taken from trees farther inland. Among 1,000 nuts from the seashore, gathered at random, 55 were found in bad condition, while out of the same number, gathered from the interior, only 15 were spoiled. This difference, it was thought, was due to the harder grounds along the seashore and the consequent greater bruising in falling.

Analyses are given of nuts from Davao. One variety was from trees producing large nuts, rather pointed in shape, and the other from trees bearing small, rounder fruit. The percentage of oil in the nuts free from husks was found to be about the same in both cases.

The seed grower, C. JOHNSON (*Marietta, Pa., 1906, pp. 191, pl. 1*).—This book, believed by the author to be the first of its kind published in any country, gives detailed directions for the production of all the different kinds of vegetable and flower seeds commonly grown in the United States. A section is also devoted to bulbs and shrubs. The usual field-crop seeds, such as clover, wheat, etc., are not considered. Suggestions for originating new varieties, forms of contracts made by seed growers with seed dealers, cultural hints for the ordinary garden crops, germination, color, and vitality of seeds, and descriptions of a number of the more prominent varieties of each of the different vegetables are included.

The author states that to a large extent America still depends upon European growers for the best quality of beet, cabbage, carrot, cauliflower, kale, kohl-rabi, leek, parsnip, parsley, radish, turnip, spinach, and onion seeds, and the choicer grades of flower seeds and bulbs. America satisfactorily produces pea, bean, celery, cucumber, lettuce, melon, and certain kinds of onion seeds, as well as all the more usual field-crop seeds. Much the larger amount of flower seed produced in the United States is grown in California.

FORESTRY.

History of the lumber industry in America, J. E. Defebaugh (*Chicago: Amer. Lumbermen, 1906, vol. 1, pp. XIII+559*).—A large amount of material is here brought together relative to the history of the lumber industry since the discovery of America. Twenty-three of the 31 chapters deal with the industry in Canada. In one chapter the forest geography of North America is considered. In the 6 chapters devoted to the industry in the United States one is concerned with the forest resources, one with the public land policy in its relations to lumbering, one to forestry and forest reserves, one to tariff legislation, one to lumber production, and one to foreign trade.

Forestry statics, a handbook for the advanced sylviculturist, H. Martin (*Die Forstliche Statik. Ein Handbuch für leitende und ausführende Forstwirte sowie zum Studium und Unterricht. Berlin: Julius Springer, 1905, pp. XII+361*).—Part 1 of this work deals with the principles and methods of forestry statics, and part 2 with their application. The various chapters of part 1 take up the production of wood volume through accretion, the value and uses of wood, the production and cost of forests, and the net profits. The work is intended for the use of students and teachers.

Handbook of the timber trade, L. Hufnagl (*Handbuch der kaufmännischen Holzverwertung und des Holzhandels. Berlin: Paul Parey, 1905, pp. VIII+318, figs 28*).—This book treats of the different commercial grades of lumber and timbers, the commercial uses of different kinds of timbers, transportation of timber, etc.

Forestry problems in the United States, T. P. Ivy (*Boston: The Archway Bookstore, 1906, pp. 47*).—The author criticises present methods of conducting civil-service examinations for positions in the forestry service, discusses the effect of the Reserve Act of 1891, which he believes has had the result of considerably increasing the price of lumber and forest products, and urges more extensive sylvicultural operations in the East. As a means of broadening our forest administration he suggests a board of forest conservators of at least 7 members. A discussion is also given of the Mississippi River in its relation to forestry.

Future forest trees, A. H. Unwin (*London: T. Fisher Unwin, 1905, pp. 108, pls. 3*).—There are 3 chapters in this book, the first dealing with the German timber imports from the United States and Canada; the second with the general results of planting experiments with American trees in Germany, Austria, Great Britain, and Switzerland, and the third with the sylvicultural characteristics and treatment of the various American species of trees. The purpose of the book is to present in a concise manner the results of European experiments with imported American trees, most of which are ornamental, for the benefit of English forestry.

Forestry division, K. A. Carlson (*Orange River Colony Dept. Agr., Ann. Rpt., 1 (1904–5), pp. 45–123*).—This gives an outline of the forestry work of the division for the year, with an account of the forest reserves, individual plantations, nurseries, revenues, expenditures, etc.

About 2,700 acres are under the control of the forestry division, on 93 of which plantings have been made. The forestry division recommends that candidates be sent by the government to Yale College to take the 2 years' course of forestry. It is believed that forestry conditions in America are more nearly like those in South

Africa than elsewhere. The cost of the course is less than half that of the English course, and it can be completed in 2 instead of 3 years, as in Europe.

About 2,000,000 cu. ft. of timber was imported into the Colony in 1903, while the average yearly importation is about 700,000 cu. ft. It is estimated that the cost of establishing timber areas in the Colony, carried out on the scale of at least 2,000 acres per annum, would be about $50 per acre, spreading over a period of 30 years.

Report forest department of the Madras Presidency for 1904-5 (*Admin. Rpt. Forest Dept. Madras, 1905, pp. 167*).—This is a progress report covering the constitution of the state forests, their management and administration during the year, and financial results. The appendixes contain details regarding the acreage of forest areas in the different districts and circles, lands under settlement, forest tracts protected from fire, the outturn of timber, fuel, and bamboo, revenues derived from different sources, etc.

Notes on the effects of frost on trees at the government nursery, Irene, L. E. TAYLOR (*Transvaal Agr. Jour., 4 (1906), No. 14, pp. 325-329*).—Three methods were employed to protect trees known to be tender to frost during the winter. These were plant shelters, large screens, and covering with Hessian cloth. The plant shelters were the most effective, and were made of rough Eucalypt poles and thin branches. A framework was built of the poles about 6 ft. high, and over this thin branches were laid at intervals of about 1 to 2 in. Although the shelters do not keep out frost, they lessen its severity by preventing radiation, which is the cause of most damage to trees during the winter. The behavior of about 90 species toward frost is mentioned in detail.

Planting white pine in Vermont, L. R. JONES (*Vermont Sta. Bul. 120, pp. 67-80, figs. 7*).—An account is given of forestry conditions in Vermont, with directions for starting a pine forest, either with seeds, natural seedlings or nursery stock, and the after care to be given it.

On the University farms an experimental tree plantation was made some 8 years ago on a dry, sterile, sandy soil, originally covered with pitch pine. The trees planted were black locust, red oak, white birch, chestnut, cottonwood, box elder, European larch, Norway spruce, and white pine, but only locust and white pine have given promise of profitable return. There is some doubt as to whether locust will be able to survive the attacks of borers, but the white pine has proved an unqualified success. White pines that have been planted for 8 years now stand 7-9 ft. high and have made a growth of 2-4 ft. the last 2 summers.

The starting of a forest by sowing seed broadcast is believed to be a hazardous undertaking. Special attention is called to the fact that the year 1904 was a pine-seed year and that there is an abundance of 1-year-old seedlings now in the State, and that these may well be used for forestry purposes. On a small scale the trees may be obtained from nurseries. The estimated cost of producing trees in a nursery is placed at $2 per 1,000. Maple trees can be bought for about half the price of white pine trees, and it is therefore more economical to plant about half and half maple and pine. Pines grow as well as in pure stands, and as soon as they overtop the maples they will kill out most of them. This will occur in about 20 years, and if this natural thinning is not sufficient the maples should be cut out.

The catalpa tree for cross-ties (*Arboriculture, 5 (1906), No. 3, pp. 69-81, figs. 8*).—This is a report of F. I. Brown, as chairman of the Committee on Roadway and Ballast of the Pennsylvania Railway, on the use of the catalpa tree for cross-ties, and is essentially a compilation of information on the value of *Catalpa speciosa* for lumber, posts, ties, etc.

The value of cultivated rubber to the manufacturer (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 5, pp. 657-659*).—This paper was prepared by C. P. Fox, of Ohio, and is reprinted from the *India Rubber Journal*, August 28. It contains an account of experiments with a large number of varieties of rubber to deter-

mine their tensile strength. The data obtained are tabulated and the following conclusions drawn:

"Ceylon fine, when used to denote the oriental source of fine Para, means a grade lacking in uniformity when the tensile strength is considered. The curing qualities of Ceylon fine indicate that it has a decidedly slower action than the South American product. A future paper will show this difference more clearly. Mill deportment indicates that all of these oriental samples are much softer and are less nervous than the occidental types."

The spiral system of rubber tapping, I. ETHERINGTON (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 5, pp. 641–646, pl. 1*).—A description of the spiral system of tapping worked out by C. Northway and E. D. Bowman on the Deviturai Estate in the Southern Province of Ceylon. This method of tapping is used on *Hevea brasiliensis*. It is employed only on trees which have a girth of 18 in. or more 3 ft. from the ground, or when about 5 years old.

The first time trees are only lightly tapped up to a height of 4 ft. from the ground, starting 1 ft. from the base of the tree. The first process is to mark the place for the spiral cut. This is done in stenciling ink with a sheet-tin guide. On young trees at the first tapping 2 spirals only are cut parallel and 1 ft. apart, each spiral going once around the tree. The spiral cuts are made at an angle of 45° or more; the younger the tree, the greater should be the slope. On older trees the spirals are continued up the tree to 6 ft. high or more.

The first cut in the trunk is made with a special knife, which is used as if it were a plane. The following day the cut is reopened with a paring knife having a steel spring, which works against the trunk to prevent cutting the cambium. On alternate days the shaving knife is replaced with a pricking tool, which is a small revolving spur fitted on a handle. This is run along the edge of the spiral cut, puncturing the bark close against the previous day's wound and along the wound surface. The object of the pricker is to save cutting away the bark so quickly. When the shaving knife alone was used it was found that 2 in. width of bark was cut away in one month, and when the pricker was used on alternate days only 1 in. of bark was removed per month. The flow of latex produced by the pricker seems just as full as that produced by cutting the bark.

The average yield of rubber by the V system of tapping on the estate was 1 lb. per tree per annum and by the spiral system 5 lbs. per tree per annum. In 1903, 248 trees of various girths gave 240 lbs. of rubber by the V tapping. These same trees the following season by spiral tapping yielded 1,317 lbs. of rubber. The tapped trees appear to be less injured under the spiral system than under the old V system of tapping.

In the case of young trees it is believed that tapping should not start until the trees begin to flower; that is, the fifth year. The labor required under this system is about 5 trained coolies per acre. Each cooly can tap about 400 lineal feet or 720 in. of girth per day, or 30 to 40 trees.

The yields from the trees noted above were obtained on swampy land not believed to be especially suited to rubber production. It is stated that this system of tapping is .pidly being extended.

Ceara rubber in Brazil (Manihot glaziovii), A. MOULAY (*Un arbre à caoutchouc du Brésil, le Manisoba. Paris: A. Challamel, 1906, pp. 31, figs. 16*).—A botanical description is given of this species of rubber, with an account of its culture in Brazil, including methods of extracting the latex, and the production of hard rubber.

Sapium aucuparium in Ceylon (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 3, pp. 425, 426*).—It is stated that this tree is grown in Ceylon under the name of *S. biglandulosum*. It grows to a height of about 40 ft. and seeds freely. In tapping experiments the latex dried to a brittle resinous substance, and planters are advised to wait and see what products can be obtained by mixing the latex of this

species with that of Para rubber before planting extensively. Other species of Sapium found growing in Ceylon are *S. indicum*, *S. insigne*, and *S. sebiferum*. The seeds of the latter are coated with "tallow," which is used in the place of animal tallow for the manufacture of candles, soap, etc.

Species of forest trees in Soudan, M. CONSTANCIA (*Les essences forestières du Soudan, propres à la construction. Paris: A. Challamel, 1906, pp. 68*).—Descriptions are given of the various forest trees of French Soudan, with an account of their usefulness for various purposes.

Philippine wood oils, A. M. CLOVER (*Philippine Jour. Sci., 1 (1906), No. 2, pp. 191–202*).—A chemical study was made of the oils obtained from a number of Philippine woods. The principal oils studied are the oil of Supa, obtained from the tree *Sindora wallichii;* Balao, or oil of Apitong, derived from various species of the genus *Dipterocarpus*, the chief use of which appears to be in calking small boats and as a protective varnish for woods; and Malapaho, or oil of Panao, from the tree *D. vernicifluus*.

DISEASES OF PLANTS.

Incomplete experiments for 1905, L. F. HENDERSON (*Idaho Sta. Rpt. 1905, pp. 14–22*).—Brief accounts are given of a number of experiments which are in the main incomplete. The investigations included spraying for the prevention of apple scab and codling moth, combating pear blight and tomato blight, destruction of dandelions, spraying for the prevention of rose mildew and rose aphis, and spraying for the elm aphis.

The spray for the prevention of apple scab and codling moth consisted of Bordeaux mixture, to which was added some form of arsenical preparation, but the results were negative, no marketable apples being found in the orchard at the end of the season.

In the experiments with pear blight the wounds made by cutting out diseased portions of the trees were covered with a mixture consisting of sulphur and carbolic acid. This was used quite liberally in covering the wounds, and there seems to be some evidence to indicate that its use was followed by good results. The experiments with tomato blight were practically a failure, although plants from seed placed directly in the field where they were to stand were somewhat more promising than others.

In the eradication of dandelions the author applied kerosene, brine, and gasoline to the plants, and where gasoline was applied the dandelion was killed without any injury to the grass. The other treatments were not wholly efficient in destroying the weed and the grass was often destroyed for several inches about the point of application. A number of mixtures were tested for combating the rose mildew and aphis, the best results being obtained where whale-oil soap and potassium sulphid were combined.

Spraying for the prevention of elm aphis consisted of winter or early spring treatment with the lime-sulphur spray, and where well applied the trees were protected against injury. Thorough applications must be given the trees, so as to reach all the eggs, which are deposited in crevices of rough bark, especially toward the base of the trees.

Indiana plant diseases in 1905, F. D. KERN (*Indiana Sta. Bul. 111, pp. 123–134*).—A résumé is given of the plant diseases observed in Indiana in 1905, the data being compiled chiefly from reports by correspondents made in response to a circular letter sent out by the station.

The summary indicates the prevalence of the more important diseases and estimates the extent of injury as compared with the previous season, whenever possible. The various crops are taken up and under each are listed the diseases observed, and where any are known, methods are given for their prevention. Formulas are given for the preparation and use of fungicides in connection with combating plant diseases.

The occurrence of plant diseases in Vermont in 1904, L. R. JONES and W. J. MORSE (*Vermont Sta. Rpt. 1905, pp. 267–271*).—Data are given showing the mean temperature, rainfall, number of clear and cloudy days, etc., and the authors call attention to the close relationship between plant diseases and weather conditions.

Brief notes are given on a number of diseases observed during the period covered by the report, particular attention being given to those of the potato, and 2 new leaf spot diseases are described. The first of these diseases made its appearance early in July, a few plants showing small black spots on the leaves, which suggested the presence of early blight. Upon closer observation it was seen that the blackening began on the under side of the veinlets and spread more rapidly along the veins than laterally. No fungus was detected in connection with the spotting. One hill of affected potatoes was dug and the root system, tubers, and bases of the stem seemed sound. The other infected plants were kept under observation until the death of the plants in September. The spots gradually enlarged, still bearing a close resemblance to the early blight, but remained sterile.

In the authors' judgment it is a nonparasitic disease, involving the plant as a whole, the local spotting of the disease being merely a symptom. It is believed to be the same disease observed by one of the authors in Germany and also in England, and a similar trouble was noticed on specimens of the Mexican *Solanum polyadenium* in the horticulturist's potato collection.

The other disease appears to be unrecorded in this country and was first noticed on early planted Early Rose potatoes. The plants exhibited obscurely defined pale yellow spots ⅛ to ¼ in. in diameter, and the lower surfaces of the spots were covered with a delicate gray growth, evidently a Cercospora. In the gross appearance of the spots and in its occurrence and destructiveness the disease was much like that caused by *Cladosporium fulvum*, which was developing at the same time on neighboring tomato plants. This disease spread during July to another variety of potatoes in an adjacent plat and showed slight development in other plats later in the season. It caused considerable damage from hastening the death of the vines of the earlier potatoes, but did no appreciable harm on the later varieties.

The fungus is being studied to determine its specific and cultural characters.

The part taken by teleutospores and æcidia in the distribution of maize and cereal rusts, J. C. ARTHUR (*Proc. Soc. Prom. Agr. Sci., 26 (1905), pp. 94–98*).—Attention is called by the author to the recent discovery of the æcidial stage of corn rust on the common wood sorrel (*Oxalis* sp.).

Hitherto this form of the rust had not been known and knowledge of the life history of the fungus remained incomplete. Having discovered the æcidial stage of the rust, this gap is filled, but the author states that the usual infection is probably through the blowing of the uredospores from the regions where the corn is not completely killed by frost. The blowing northward of these spores may cause successive infections in new localities as the season advances, and thus spread the rust throughout the country. In addition the germinating teleutospores reach plants of Oxalis, from which direct infection to the corn plant becomes possible.

The distribution described above for the corn rust is said to apply almost equally well to some of the rusts of other cereals.

Rust problems, H. L. BOLLEY and F. J. PRITCHARD (*North Dakota Sta. Bul. 68, pp. 607–676, figs. 30*).—An account is given of rusts of cereals and other plants, the principal aim of the bulletin being to provide a compendium of the theories and known facts involved in the rusting of cereals and other important farm crops, to give the lines and results of new observations and experiments, and to cite investigations and farm practices which give promise of future success in combating or preventing crop destruction by these fungus pests. The authors describe various forms of rusts, giving an account of their effect on the host plants, the alternate generations of a number are mentioned, and accounts given of the method by which the fungus is carried over from one season to another.

Among the recent observations, attention is called to the fact that in connection with shriveled grains the authors found spore beds containing both uredospores and teleutospores beneath the bran layer, and this seemed to indicate that possibly the wheat rust could attack the plant directly from the seed. Infected seed generally may be recognized by black-pointed grains, the black points being situated at the germ end of the grain. A number of seeds of this character were planted in glass cases, but the resultant plants did not show any rust. If later experiments should confirm this possible mode of rust propagation, new light may be thrown on the entire rust problem, and the importance of proper seed selection would be shown.

Suggestions are given as to precautionary measures to be taken by farmers in order that the amount of rust may be reduced as much as possible. These include the thorough drainage of fields, the early and even maturity of the crop, thorough preparation of the soil and the use of clean seed, the selection of seed of pure varieties, treatment for prevention of smut so as to insure healthy plants if possible, keeping down weeds and volunteer plants which may carry the rust, destruction of all barberry shrubs, thorough grading of seed grain, and the rotation of crops.

Plant diseases, J. J. THORNBER (*Arizona Sta. Rpt. 1905, pp. 21, 22*).—Brief notes are given on the alfalfa leaf spot (*Pseudopeziza medicaginis*) and the common grain rust (*Puccinia graminis*).

Notes on Puccinia graminis, J. JOANNIDES (*Trans. and Proc. Bot. Soc. Edinb., 23 (1905), pl. 1, pp. 63–67*).—The author records observations on the occurrence of *Puccinia graminis* in Egypt and describes the continued existence of the rust during several years without the usual presence in the life cycle of the teleutospore condition and the subsequent æcidial stage on the barberry.

Culture experiments with rust fungi, H. KLEBAHN (*Ztschr. Pflanzenkrank., 15 (1905), No. 2, pp. 65–108, pl. 1, figs. 4*).—Notes are given on experiments carried on by the author during 1903 and 1904 with some 30 species of rust fungi.

Among the data given are special references to the wintering of *Puccinia dispersa;* the specialization of *P. digraphidis;* the alternate hosts of *P. stipæ;* the specialization of *P. caricis;* notes on *P. polygoni amphibii, P. violæ*, etc.; a new form of *Uromyces dactylidis;* the specialization of *U. scirpi;* notes on *Gymnosporangium clavariæforme* and *G. juniperinum;* the relationship between *Ochrospora sorbi* and *Æcidium leucospermum;* infection experiments with *Cronartium ribicola* on white pine, etc.

Helminthosporium gramineum and Pleospora trichostoma, F. NOACK (*Ztschr. Pflanzenkrank., 15 (1905), No. 4, pp. 193–205, pl. 1*).—A report is given of the investigations of the author on the possible relationship between these two species of fungi, and he agrees with Diedicke (E. S. R., 16, p. 64) in holding that *Pleospora trichostoma* is the perithecial form of *Helminthosporium gramineum*, the cause of the stripe disease of barley.

Investigations with *H. teres* and *H. avenæ* have thus far failed to reveal their perithecial stage.

The prevention of stinking smut of wheat and loose smut of oats, W. T. SWINGLE (*U. S. Dept. Agr., Farmers' Bul. 250, pp. 16, figs. 7*).—The author describes means for the prevention of the stinking smut of wheat and loose smut of oats, the methods detailed being the treatment with sar, which consists of a mixture of sulphur, alkali, and resin; the bluestone or copper sulphate and lime treatment; formalin treatment; and hot-water treatment. Directions are given for the use of these fungicides and for the handling of the grain after treatment.

The smut of wheat, C. MACÍAS (*Com Par. Agr.* [*Mexico*], *Circ. 27, pp. 4*).—A brief account is given of smut of wheat, with directions for its prevention.

Disease resistance of potatoes, W. STUART (*Vermont Sta. Bul. 122, pp. 107–136, dgms. 4*).—In previous publications (E. S. R., 17, pp. 262, 670) accounts are given of studies of disease resistance of potatoes. The present bulletin gives the results of investigations on the resistance of vines to blight and tubers to rot. Investigations

were also carried on upon the resistance of tubers to scab, but the results so far obtained are inconclusive.

More than 150 varieties of potatoes were brought together from Europe and this country and planted under identical conditions, some being planted in clay loam and others in sandy loam. Frequent observations were made as to the presence of diseases and the relative amount of infection. There was some evidence that some of the varieties on the sandy loam were more disposed to the early blight, due to *Alternaria solani*, than others. The same is true of resistance to tip burn.

The principal investigations, however, were in connection with the late blight (*Phytophthora infestans*). This disease made its appearance about August 10 on Delaware and Green Mountain varieties, spreading slowly, the weather conditions during August not being propitious for its rapid development. The results of the investigations of the foliage are tabulated, from which it appears that a marked difference was to be observed in varieties. The resistance that is claimed for *Solanum commersoni* to late blight was found to be unwarranted under the conditions of the experiments.

In connection with the investigations on the resistance to potato rot a careful examination was made of all tubers as soon after digging as possible, and a list of the American varieties showing the greatest resistance to rot on the sandy and the clay loams is given. Keeper, American Wonder, Dakota Red, Doe Pride, and Late Blightless were the most resistant in both sandy loam and clay loam. The comparative rot resistance of European and American varieties is discussed, and it was found that on both sandy and clay loam the Dutch, German, and English-Scotch varieties showed much less rot than did the French and American varieties. While disease resistance is important, the commercial standards of this country favor qualities in which the German and Dutch varieties are inferior to the American varieties, and at present the writer does not feel warranted in recommending them to American growers.

The relative susceptibility of varieties which form their tubers deep or shallow was investigated, it having been claimed that those forming their tubers near the surface are more subject to rot than others, and while some differences might be noted, yet in both classes of soil about the same proportion of each was affected.

Potato diseases and their remedies, L. R. Jones and W. J. Morse (*Vermont Sta. Rpt. 1905, pp. 272–291*).—In continuation of investigations reported in a previous publication of the station (E. S. R., 17, p. 261) accounts are given of spraying experiments, relation of date of digging to development of potato rot, relation of storage conditions to development of rot in potatoes, studies regarding the time and method of tuber infection by the rot fungus, and gaseous disinfection for potato scab.

The spraying experiments, which were conducted for the prevention of both late blight and rot, were carried on in the field. Bordeaux mixture, consisting of 6 lbs. of copper sulphate, 4 lbs. of lime, and 40 gal. of water, with the addition of ½ lb. of Paris green, was employed, 2 applications of the mixture being given the plants on August 2 and 21, respectively. At the expiration of the season the tubers were dug, and the gain at the rate of 161 bu. per acre is attributed to the application of the fungicide. The authors present in tabular form the gains from the use of Bordeaux mixture on late potatoes, covering experiments for the past 15 years in which the average gain for that period is 119 bu. per acre due to the treatment.

In a previous report (E. S. R., 14, p. 1084) the authors called attention to the method by which the spores of the fungus are carried from the leaves to the tubers, and suggested spraying the soil with Bordeaux mixture for preventing this infection. The previous trials were repeated in 1905 with good results, and the investigations show that not only does the disease pass from the leaf to the tuber, but the main channel is through the soil rather than through the stem. Spraying experiments for the control of the early blight showed the effect of thorough application of the fungicide,

the increased yield being attributed to the beneficial effects of the Bordeaux mixture, not only in checking the development of the fungus, but in deterring insect attacks.

In investigations on the relation of the date of digging to the development of the potato rot, results quite different from those previously reported (E. S. R., 17, p. 261) were obtained. In 1905 there was a greater loss from later digging than from earlier, and this is at variance with the previous rule laid down that digging should be deferred as long as possible where the rot is expected. In the authors' opinion this rule will have to be modified by making an exception of heavy wet soils during wet seasons.

Experiments were carried on to test the effect of liming, disinfection with formalin, sun-drying the tubers, and the temperature of storage on the development of rot in potatoes. It was found that instead of being an advantage in the preservation of tubers, the application of lime actually favored the development of rot. Disinfecting with formalin was without any material effect in checking it. In testing the relation of moisture to the development of rot it was found that potatoes exposed as much as practicable to sun and air prior to storage are less subject to rot than those stored immediately. The various temperatures of storage investigated were 40, 53, and 70°, and the greatest proportion of the crop saved was at the lowest temperature.

In studying the time and method of tuber infection different lots were subjected to different treatments. One lot was exposed for 36 hours to infection from blighting tubers immediately after digging, a second lot was not artificially infected but kept moist for 36 hours, and a third lot was stored without treatment immediately after digging. The relative loss was 92 per cent where the tubers were infected and not washed, 100 per cent where infected and washed, 77 per cent where not infected but kept moist for 36 hours, and 54 per cent where stored at once without any treatment. Concerning the possibility of spread in the storage cellar, it was found that spores may be produced in storage, and that well ripened sound tubers were readily inoculated with the fungus spores. From this it appears that there is no doubt as to the possibility of infection of tubers in storage.

In continuation of trials of gaseous disinfection for potato scab (E. S. R., 17, p. 261), the authors tested the relative value of gas treatment as compared with soaking seed for disinfection against scab, and also the merits of different ways of generating the gas. All the methods of disinfection showed marked gains in smooth tubers, but none of them gave a crop wholly free from scab. The average results obtained with the vapor treatments were better than those secured where the seed tubers were soaked in formalin solution, and the authors are led to recommend treatment of seed tubers with formalin gas by the permanganate method without the addition of steam. The cost of this treatment would be approximately $1.50 per 1,000 cu. ft., and this method is recommended only for those seed potato specialists who may wish to disinfect large quantities of tubers.

Concerning disease resistance of potatoes, L. R. JONES (*Vermont Sta. Rpt. 1905, pp. 264–267*).—A brief account is given of investigations carried on by the author in connection with the Bureau of Plant Industry of this Department regarding the resistance of potatoes to various diseases, a preliminary report on which has already been issued (E. S. R., 17, p. 60).

The potato leaf curl (*Jour. Bd. Agr. [London], 12 (1905), No. 8, pp. 476–478, fig. 1*).—A description is given of the potato leaf curl or early blight (*Macrosporium solani*), and its occurrence is noted on *Solanum commersoni* grown at Kew.

Sal Bordeaux for potato blight, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 126, pp. 34, 35*).—In a previous publication of the station (E. S. R., 16, p. 1093) it was shown that dry Bordeaux as a fungicide was inferior to Bordeaux mixture as usually applied.

In 1905 an experiment was carried on to test the value of a dust spray known as Sal Bordeaux. This consists of equal parts of lime and exceedingly finely ground

copper sulphate, and it is applied as a dust on the theory that as soon as this dust becomes moist, from dew or otherwise, the regular Bordeaux mixture in concentrated form will be produced on the foliage. A number of plats received treatment with this fungicide at the rate of 3, 6, and 10 lbs. per acre. There was no blight on either the treated or untreated plats, so the results are considered inconclusive, and it is planned to repeat the experiment in 1906.

In connection with these experiments Paris green was used to prevent the ravages of bugs, and where it was applied in connection with the dry powder it was not as efficient as where the insecticide was administered in the form of a spray.

Further experience in asparagus rust control, R. E. SMITH (*California Sta. Bul. 172, pp. 21, figs. 7*).—In continuation of experiments previously reported (E. S. R., 16, p. 66; 17, p. 48), the author gives an account of experiments carried on in California and elsewhere to control the asparagus rust, the principal information in the present publication being based on the results of practical work of various growers, especially observations made in connection with a ranch at Milpitas, Cal.

At this ranch the asparagus cutting was stopped about the first of July, and the rust was less abundant than usual on the uncut tops, but developed very vigorously after the beds grew up. An especial effort was made to keep down the wild growth about the edges of the field, which had in previous years caused a large amount of infection. After the end of the cutting season and the usual plowing and cultivation, the field was irrigated in order to start as vigorous a growth as possible. About August 1 heavy dews occurred, and the first application of sulphur was made. A special form of apparatus was employed, and sublimed sulphur at the rate of about 100 lbs. per acre was applied. Three weeks later a second application was made, and a third was given after a second interval of about 3 weeks.

The results of the treatment were quite apparent from the condition of the treated field. All untreated fields in the neighborhood were badly rusted in September and the tops were black and dead in October, while the field receiving the sulphur made a fine growth and the plants remained green until the normal end of the season. The cost of the treatment was at the rate of $6 per acre for the season's work on 75 acres, and from the experience obtained it was thought possible to reduce this cost to about $4 per acre for future treatments.

Other growers in the same locality applied sulphur to asparagus, and the results obtained were in proportion to the efficiency of the application. Near Sacramento attempts were made to control the rust with liquid sprays, and where Bordeaux mixture alone was used the effect on the rust was very slight. When sulphur was used in connection with the sprays, much better results were obtained, and based upon the trials of a number of growers, the following treatment has been adopted for future use: Three weeks after cutting, the plants are to be sprayed with whale-oil soap and water, followed by a dusting of sulphur at the rate of about 150 lbs. per acre. One month later sulphur is dusted over the plants at the rate of about 200 lbs. per acre, the applications to be made on dewy mornings.

The author cites illustrations of the use of sulphur for the control of the asparagus rust in other localities in California and also in South Carolina, where the treatment proved eminently successful.

In applying the sulphur the chief requisite is to scatter it so that it will cover all the growth in a dusty, smoky cloud. Experiments with ground and sublimed sulphur and flowers of sulphur showed that when all things are considered the flowers of sulphur is the most satisfactory and economical.

In conclusion the author states that in treating asparagus it is necessary to get a good coating of sulphur on the tops just before the rust is due to appear. A second application should be made 1 month later, and a third after another interval of about 4 weeks. Where young beds of asparagus are to be protected from rust, the author recommends a special form of treatment, which consists of spraying the

plants with whale-oil soap, to be followed by an application of sulphur, scattered by hand.

White rust of cabbages (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 8, pp. 480, 481, fig. 1*).—A brief account is given of the occurrence of *Cystopus candidus* on cabbages. As the white rust most frequently occurs on shepherd's purse, it is recommended that all weeds of this kind should be destroyed in the vicinity of other crops that are liable to be infected by the fungus.

Tomato diseases in California, R. E. SMITH (*California Sta. Bul. 175, pp. 16, figs. 8*).—A preliminary report is given on the cause, nature, and possible means of prevention of some diseases of the tomato which have become exceedingly destructive in parts of California, and the further investigation of which is to be prosecuted in connection with the work of the new pathological laboratory for southern California.

The diseases described are the damping-off, which is due to one or more species of fungi, the summer blight, which is attributed to attacks of an undetermined species of Fusarium, and the winter blight, which is caused by the fungus *Phytophthora infestans.* For the damping-off, which is most prevalent in seed beds, the use of fresh earth, thorough ventilation, and the avoidance of overcrowding the plants are recommended as precautionary measures, and spraying with Bordeaux mixture, followed by sprinkling with sulphur, is advised where the disease has become established.

For the summer blight, which is due to a soil fungus, the only recommendation that can be made at present is planting healthy plants in new soil. Applications of lime, sulphur, etc., to the soil may be tried, but the effect of such treatment has not yet been demonstrated. Spraying can probably be of no use in connection with this disease. For the prevention of the winter blight, which occurs only after heavy rains or heavy fogs and dews, and in California affects only the winter crop of tomatoes, spraying after every rain with Bordeaux mixture is recommended.

A Fusarium disease of tomatoes, E. VON OVEN (*Landw. Jahrb., 34* (*1905*), *No. 3-4, pp. 489-520, pls. 2, fig. 1; abs. in Centbl. Bakt.* [*etc.*], *2. Abt., 15* (*1905*), *No. 15-16, pp. 491, 492*).—In 1901 and again in 1904 there appeared on tomatoes in the vicinity of Berlin a disease that became epidemic, causing considerable losses of the fruit.

Upon the blossom end of both green and ripe fruit appeared black spots that enlarged, and, through the softening of the underlying tissues, gave a wrinkled appearance to the fruit, which finally became a dried mummified mass. An investigation of the material showed there was a fungus in the tissues, and also abundant bacteria. Subsequent studies seemed to show that the bacteria were of secondary importance, finding entrance only after the destruction had been begun by the fungus.

The cause of the disease is said to be a species of Fusarium. The fungus appears to be usually a wound parasite, under normal conditions not being able to penetrate the epidermis of the fruit, but when especially abundant and vigorous in growth it seems to cause infection.

The author describes the results of inoculation experiments with the organism, which seems to be an exceedingly variable one, and which survives the winter in the numerous sclerotia formed in the mummy fruits. The fungus is described as a new species, with the name *Fusarium erubescens,* and it is critically compared with several other species of Fusarium.

Experiments have shown that weak solutions of Bordeaux mixture have little effect in checking the growth of the fungus. Therefore it is suggested that tomatoes should be sprayed with strong solutions of Bordeaux mixture as soon as the disease makes its appearance.

Bacterial disease of tomatoes (*Bd. Agr. and Fisheries* [*London*], *Leaflet 152, pp. 2, fig. 1*).—A description is given of a bacterial disease of tomatoes that has been

known as occurring in France for a considerable time, where it has assumed the proportions of a destructive epidemic. It has been recently reported in several widely separated localities in England, on which account attention is drawn to it.

The symptoms of the disease are said to be very marked and can not be confounded with those of any other tomato disease at present known. When the tomato is about the size of a marble a minute black patch appears at the base of the style. This patch gradually increases in size, retaining a circular outline, until eventually the entire fruit is reduced to a blackish, soft, decayed mass.

Experiments have shown that infection takes place during the flowering stage and that the bacteria causing the disease are deposited on the stigma by flies visiting the flowers.

The stigma seems to be the only vulnerable part under ordinary conditions, but if bacteria from a diseased fruit are introduced into the flesh of a healthy tomato, infection follows.

The disease does not appear to be influenced to any extent by the forcing methods commonly followed, as it has been observed in houses where the temperature was kept comparatively low.

When the disease appears all diseased fruit should be removed as quickly as possible, and insects should be excluded by using insecticides. Where this is done, artificial pollination will be necessary.

The blight canker of apple trees, H. H. WHETZEL (*New York Cornell Sta. Bul. 236, pp. 101–138, figs. 36*).—A description is given of a form of apple-tree canker which is due to the same cause as that which produces the bacterial or fire blight of the pear. It seems to be favored by rapid growth of the trees, and the points of inoculation are water sprouts, wounds, and possibly the flowers. After reviewing the different kinds of cankers that have been described as occurring on apple trees, the author gives the distinguising characters and appearance of the canker treated in this bulletin, which is due to *Bacillus amylovorus*.

These cankers occur most frequently on the bodies and limbs of young trees, and the diseased areas are sunken and smooth, covered with a brown surface, but not showing any pimples or fungus fruit bodies, which characterize some of the other forms of fruit-tree canker. The effect of the disease on the tree is to lower its vitality by cutting off the food supply to the roots and indirectly reducing the flow of sap to the branches and leaves.

Inoculation experiments have shown that the disease can be readily caused through wounds. As preventive measures the author recommends the burning of all dead limbs and trees as promptly as possible and cutting out and burning every trace of twig blight on both apple and pear trees as soon as detected. When pruning, all cut surfaces should be treated with corrosive sublimate or copper sulphate solution. Water sprouts should be cleaned from the trees, and the excessive use of nitrogenous fertilizers should be avoided. When possible the planting of varieties known to be resistant to the disease is recommended. Wolf River and Talman Sweet appear to be quite resistant, while Baldwin and Ben Davis suffer severely. In order to prevent the spread of the disease the author suggests an early spring treatment with lime-sulphur wash.

Notes are given on the distribution and severity of the disease throughout New York, and a detailed account is given of the identity of the organism, and notes on its morphology, cultural relation, etc. A bibliography of the publications relating to this disease completes the bulletin.

A fungus disease of the mandarin orange, P. A. SACCARDO (*Separate from Ann. Mycol., pp. 3; abs. in Ztschr. Pflanzenkrank., 15 (1905), No. 3, p. 175*).—The author states that mandarin oranges were noticed in Naples that showed dark spots on the rind, the spots later becoming confluent.

Upon examination the rind was found matted with mycelium which when old became of a dark violet color. When placed in a moist chamber there soon developed on the rind violet black hyphæ and conidiophores that characterize *Alternaria tenuis*, but the fungus differed in some respects from this species. The author has described it as a form of the above species, naming it *A. tenuis chalaroides*.

A disease of bananas in Central America, H. PITTIER DE FABREGA (*Jour. Agr. Trop., 5 (1905), No. 54, pp. 379, 380*).—A brief account is given of a disease of bananas, the origin of which is in doubt, but which has caused the destruction of hundreds of hectares of plants in Costa Rica and Panama. The author holds that the disease is due to faulty drainage, the soil having been saturated by heavy rains and lacking cultivation.

The American gooseberry mildew, J. ERIKSSON (*K. Landtbr. Akad. Handl. och Tidskr., 44 (1905), No. 4-5, pp. 273-288*).—The author describes *Sphærotheca mors-uvæ*, which is said to have first appeared in Sweden in 1902 and in Ireland in 1900, in Russia in 1901, and in Denmark in 1904.

An account is given of the distribution of the fungus in the United States, its life history, and methods of combating it. Among the protective measures recommended are the planting of healthy stocks, early destruction of badly affected bushes, and spraying the bushes and ground with potassium sulphid (30 gm. to 10 liters of water). When bushes are only slightly affected the diseased parts should be cut off and burned in the fall and the bushes sprayed early in the spring before the leaf buds appear. The spraying should be repeated every 8 to 14 days until the berries have attained about half their mature size.—F. W. WOLL.

Black blight in Granada, R. D. ANSTEAD (*Agr. News [Barbados], 4 (1905), No. 96, p. 394*).—In a report to the Agricultural Committee of Granada, the author deals with the nature and control of the black blight that is prevalent in that island, attacking mango, bread fruit, sapodilla, guava, and rose apple trees. The blight is due to a species of Capnodium, which follows the presence of a number of scale insects.

For the prevention of the disease the author recommends cultivation of the plants, clean culture, and the use of insecticides against the scale insects.

Gray blight of tea, T. PETCH (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 5, pp. 630, 631*).—The author gives a note on the gray blight of tea, which is attributed to the fungus *Pestalozzia guepini*, and calls attention to the fact that spores indistinguishable from those producing the gray blight are formed on rose leaves attacked by *Actinonema rosæ* when kept in a moist chamber for some days. This form has been called *P. suffocata*, but the author believes the differences are so slight as to indicate the possible identity of this species with the one above.

The gray patches on tea leaves are said to be well known, but in some cases the fungus attacks the leaf stalk at the junction of the stem, in which case the leaf turns brown, falling from the bush before producing any indications of the disease on the leaf. The stem of the bush may also be attacked, the fungus entering the young shoot at the cut end left in gathering the tea, in which case the young shoot is killed to the base. It also occurs on stems an inch or more in diameter, forming a kind of canker. A similar fungus is said to attack *Hevea brasiliensis*, causing slight damage to the leaves, but the plants in a short time recover from the attack.

The bud rot of the cocoanut palm (*West Indian Bul., 6 (1905), No. 3, pp. 307-321; noted in Agr. News [Barbados], 4 (1905), No. 95, pp. 369, 370*).—Mention has already been made of the occurrence in various parts of the West Indies of a serious disease of cocoanut palm known as the bud rot. This has recently become prominent in Trinidad, where one plantation reports the loss of 2,000 trees in 6 months.

The cause of the disease has been attributed to the fungus *Pestalozzia palmarum*, but recent investigations (E. S. R., 17, p. 158) seem to indicate that bacteria play an important part.

It is said that probably no remedial measures will be found effective in the case of palms already seriously attacked, but to prevent the further spread of the disease all affected palms should be cut down and burned or buried with lime. Experiments in Jamaica have shown that spraying with Bordeaux mixture on the first indication of the disease is somewhat effectual. As the disease is of a virulent character, energetic efforts are recommended to stamp it out.

A green-skinned variety of cocoanut in Jamaica is said to be less liable to bud rot than the yellowish and reddish varieties commonly grown, and if this should be confirmed it may be possible to establish a race of cocoanuts resistant to disease.

Cacao disease in Ceylon (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 2, pp. 293-296*).—The cacao trees in Ceylon are subject to a serious disease, which finds favorable conditions for its spread in dense shade and abundance of moisture commonly found on cacao plantations.

The disease, which is of fungus origin, attacks both fruit and stems. The pods become dark brown or black, and unless controlled the disease spreads rapidly. The disease can be restrained by collecting and destroying the diseased pods at frequent intervals, or by spraying with Bordeaux mixture. In addition the shade should be removed to some extent and the diseased tissues of the stems collected and burned.

In 1902, 96 per cent of the trees and 14 to 62 per cent of the pods of a plantation were attacked by the fungus. The preventive measures described above were begun in 1902 and within 6 months an improvement was noted. In 1904 less than 4 per cent of the fruit was attacked and the yield increased from 0.83 cwt. per acre in 1902 to over 2 cwt. in 1904.

Canker of rubber, T. PETCH (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 2, p. 298*).—In a report on the canker of *Hevea brasiliensis* mention is made of the fact that a large portion of the fruit did not ripen and split in the normal way, but remained on the tree and blackened or fell off without splitting.

An examination showed that this condition is due to a parasitic fungus similar to, if not identical with, that which causes the decay of cacao pods, which is generally attributed to *Phytophthora omnivora* and *Colletotrichum incarnatum*, the first of which is the more destructive. The Hevea fruits examined were all attacked by a species of Phytophthora which permeates the soft outer tissues of the fruits, causing the seeds to dry up. All diseased fruit should be collected and burned as a precautionary measure.

A disease of Hevea seedlings, T. PETCH (*Trop. Agr. and Mag. Ceylon Agr. Soc., 24 (1905), No. 12, p. 138*).—A report is given of leaves of Hevea seedlings being attacked by a species of Helminthosporium.

The leaves were studded with circular, semi-transparent spots, each surrounded by a brown layer. It is thought probable that the spots are due to insect punctures and that the fungus gains access to the tissues through these injuries. As a consequence of this discovery a number of nurseries of this species of rubber were examined without discovering much disease, but there were found commonly present injuries that seemed to be due to fungi, the most common of which was *Periconia pycnospora*. It is believed that the fungi were present as a result of mechanical injury, which in many instances is attributed to the burning of the leaves by light shining through globules of water collected on the foliage.

The destruction of Siberian firs in Adlisberg, H. C. SCHELLENBERG (*Mitt. Schweiz. Centralanst. Forstl. Versuchsw., 8 (1905), No. 3, pp. 269-286, pl. 1*).—In 1901 the author examined a plantation of Siberian firs that was about 30 years old and found many of the trees suffering from the attacks of some fungus. Upon closer investigation the bark was found thickly studded with the small orange-yellow fruiting bodies of *Dasyscypha calyciformis*, and where these bodies were abundant the

bark was dead and of a reddish color. The trees in general appeared unhealthy and many were dead.

Subsequently studies were made of the fungus, and comparisons are drawn between this and allied species. The development and life history of the parasite are described, after which notes are given on inoculation experiments carried on in the forest, the amount of injury caused, etc.

Root rot of logwood trees (*Agr. News [Barbados], 4 (1905), No. 96, p. 389*).—This disease, which was previously described (E. S. R., 14, p. 882), causes the destruction of trees in considerable number through the presence of a mycelium invading the roots and spreading upward into the trunk, between the bark and the wood. Although the fruiting organs of the fungus have not been discovered, it is believed to be a hymenomycete.

The disease is found in trees growing in different kinds of soils and under varying climatic conditions, and has been recently reported as spreading rapidly in Jamaica. It is contagious, spreading through the soil, and to prevent its further spread it is recommended that trenches 3 ft. deep be dug about the diseased area, when confined to definite patches. Where it is widely disseminated the clearing of the infested tract and cultivation with other crops are recommended.

Some Indian forest fungi, E. J. BUTLER (*Indian Forester, 31 (1905), No. 10, pp. 548–556, figs. 3*).—After discussing fungus diseases in general, the author describes the attacks of *Chrysomyxa himalense* on rhododendrons and different forms of *Gymnosporangium cunninghamianum*, the æcidial form of which occurs on *Pyrus pashia* and the teleuto form on cypress.

Some rose diseases, E. FOEX (*Prog. Agr. et Vit. (Ed. l'Est), 26 (1905), No. 48, pp. 616–619, pl. 1*).—The author describes the rose rust, due to *Phragmidium subcorticium*, the rose mildew (*Sphærotheca pannosa*), and the attacks of *Marsonia rosæ*, which causes the premature falling of the leaves.

For the control of the mildew the author recommends spraying with a mixture of carbonate of soda 1.5 kg., Norwegian tar 0.5 kg., and water 100 kg.

North American salvia rusts, E. W. D. HOLWAY (*Jour. Mycol., 11 (1905), No. 78, pp. 156–158*).—Technical descriptions are given of a number of species of rusts that are known to attack various species of salvia, and *Puccinia infrequens*, *P. badia*, and *P. nivea* are described as new species.

A new orchid disease, G. MASSEE (*Gard. Chron., 3. ser., 38 (1905), No. 973, pp. 153, 154, fig. 1*).—A description is given of a recently recognized disease of Oncidium, which is attributed to *Hemileia americana* n. sp.

This fungus, which is closely allied to that causing the most destructive coffee disease, threatens to become a serious pest in orchid culture if it once becomes established. The fungus forms bright orange, powdery-looking patches of various sizes on the under surface of the leaf, with corresponding areas of a sickly yellowish-green color on the upper surface. On account of the threatened seriousness of this disease, the prompt destruction of every leaf showing the symptoms above indicated is recommended.

An orchid disease, H. KLITZING (*Gard. Chron., 3. ser., 38 (1905), No. 980, p. 259*).—A description is given of *Glœosporium beyrodtii*, a new species which appears in dense masses on both sides of the leaves of *Vanda cœrulea*. The spots sometimes run together, forming dark blotches, and finally bring about the destruction of the entire plant. The fungus is briefly characterized.

The action of copper salts on plants, F. PORCHET and E. CHUARD (*Bul. Murith. Soc. Valais. Sci. Nat., 1904, No. 33, pp. 204–210, pl. 1*).—This bulletin, which was issued in 1905, gives an account of experiments which have been carried on at the Viticultural Station of Lausanne since 1886 to test the effect of copper compounds on plants, especially the practical effect in reducing disease, and the effect of fungicides on wines made from sprayed grapes.

The physiological effect of fungicides on the plants themselves, particularly with reference to fruit maturing, has also been determined. The investigations showed that treating vines with copper solutions resulted in a stimulation of growth, through the absorption of minute traces of copper, and the ripening period of the grapes was also accelerated.

To determine the penetration of copper into plant tissues an experiment was inaugurated in the spring of 1903 in which different lots of grape cuttings were potted in a peaty leaf mold and the different pots given varying amounts of copper, iron, magnesium, and cadmium salts in solution, the concentrations varying from 0.001 to 1 per cent. In 10 days the lots receiving the weaker solutions of copper began to force their buds. Eleven days later those which had received magnesium sulphate had 4 leaves, and the buds on the cuttings receiving 0.01 and 0.001 per cent copper sulphate were bursting. All others showed no growth.

At the end of 33 days all buds had burst except those receiving iron sulphate, and these were more than 2 months in developing. In the autumn it was observed that the leaves remained on the treated vines long after the check lots had lost their leaves, and the cuttings treated with magnesium sulphate and iron sulphate lost their leaves before those which received the copper sulphate solution. These retained their foliage late into the fall, ultimately losing them in direct proportion to the strength of solution with which they had been treated.

The quantity of copper in the different lots was determined late in the autumn, and it ranged from 0.0133 gram of copper per 100 gm. of dry weight for the lot receiving a 1 per cent solution to a trace in the lot receiving 0.01 per cent, and not even a trace where the more dilute solutions were used.

Recognizing the corrosive action of copper sulphate on the delicate roots formed from cuttings, this feature was investigated, and it was found that the humus in the pots had acted on the copper, causing it to lose its toxic effect upon the root tissues.

The adulteration of copper sulphate (*Jour. Bd. Agr.* [*London*], *12* (*1905*), *No. 9, pp. 542, 543*).—On account of the extensive use of copper sulphate as a fungicide and the corrosive effect of some impurities, the writer suggests that in purchasing this material demand should be made for a product of 98 per cent purity. This is practically a pure copper sulphate and is without the corrosive effect that is observed in some of the adulterated specimens.

The results of the analysis of an adulterated sample show that it contained 17.6 per cent crystallized copper sulphate and 82.4 per cent crystallized iron sulphate. As an easy test for the presence of iron in copper sulphate the writer suggests dissolving a little in water and adding ammonia with constant stirring until a liquid of a deep blue color is formed. If iron is present in any quantity it will be shown by the occurrence of brown flocculent masses floating in the blue liquid.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Agricultural zoology, G. Guénaux (*Zoologie Agricole. Paris: J. B. Baillière & Son, 1905, pp. XII + 563, figs. 168*).—The present volume includes a general discussion of the importance from an agricultural standpoint and the use of farm animals, together with an account of the habits and economic relations of birds, reptiles, amphibians, and small mammals. Particular attention is given to the feeding habits of the various species discussed.

Protection of birds which are beneficial to agriculture (*Jour. Agr. Prat., n. ser., 10* (*1905*), *No. 52, pp. 816–818*).—An international convention was held in Paris on December 6, 1905, at which time various European countries were represented, including France, Germany, Austria-Hungary, Belgium, Spain, Greece, Sweden, Switzerland, etc. The purpose of this convention was to adopt a uniform method of procedure regarding the protection of beneficial birds.

At this convention 16 articles or resolutions were adopted and some of the more important points mentioned in these resolutions may be briefly stated in this connection. Insectivorous birds, of which a list is given and to which additions may be made as more knowledge is gained concerning the feeding habits of these birds, are recommended for absolute protection as well as their nests and eggs. More stringent legislation is recommended for preventing the destruction of nests and eggs and the use of traps, cages, nets, and other devices for capturing birds. The proprietors of vineyards or gardens are to be granted the privilege of destroying birds in case they should become injurious on the premises in question. A list is also given of injurious birds.

Special report on the decrease of certain birds and its causes with suggestions for bird protection, E. H. Forbush (*Agr. of Mass., 52 (1904), pp. 429–543, pls. 2*).—An elaborate historical account is given of the former prevalence of birds in Massachusetts and neighboring States and the decrease in numbers of these birds due to various causes.

Among the agencies which may affect the destruction of birds the author enumerates the unfavorable weather of 1903–4, the destruction of birds by sportsmen, bird shooters and trappers, market hunters, boy gunners, and egg collectors. Apparently six species of game birds and water fowl have disappeared in Massachusetts within historical times and shore birds are estimated to have decreased in numbers to the extent of 75 per cent. Swallows, night hawks, eagles, great blue herons, house wren, red-headed woodpecker, and various other species of similar birds are on the decrease.

Notes are given on the natural enemies of birds, especially cats and English sparrows. In order to protect birds from further unnecessary depredations it is suggested that more attention be given in the schools to the economic value of birds and the desirability of protecting them.

Animal and insect pests, E. Wright (*Queensland Agr. Jour., 16 (1905), No. 1, pp. 67–70*).—The flying fox is considered as one of the most important fruit pests along the eastern coast of Queensland. Notes are also given on certain birds which are injurious to fruits as well as on the fruit fly and other insect pests.

Entomology with special reference to its biological and economic aspects, J. W. Folsom (*Philadelphia: P. Blakiston's Son & Co., 1906, pp. VII + 485, pls. 5, figs. 300*).—According to the author this volume is intended for the student and general reader, and was written to cover as fully as possible within the limits of the book the biological aspects of insects.

The subject-matter is arranged under the heads, classification; anatomy and physiology; development; adaptations of aquatic insects; color and adaptive coloration; origin of adaptations; insects in relation to plants, animals, and man; insect behavior; and distribution. A classified bibliography of important entomological literature is also presented (pp. 409–466). The literature of economic entomology is discussed. One of the most valuable features of the book is the discussion of the economic relations of insects.

Catalogue of publications relating to entomology in the library of the U. S. Department of Agriculture (*U. S. Dept. Agr., Library Bul. 55, pp. 562*).—This bulletin contains a classified list of 5,600 publications relating to entomology in the library of the Department. The titles are grouped under general entomology, economic entomology, faunas, and various orders of insects, Myriapods, and Arachnida A list of serial publications relating to entomology is also given and the bulletin is provided with an index to insect families and authors.

Insects of the year, W. Stuart (*Vermont Sta. Rpt. 1905, pp. 309–314, figs. 2*).—No serious outbreaks of injurious insects occurred during the season, but the usual number of requests were made concerning insect injuries of lesser importance.

Among the injurious species of which brief notes are given are woolly aphis, red-humped apple-worm, oyster-shell bark-louse, and apple-leaf miner.

The periodical cicada in 1906, C. L. MARLATT (*U. S. Dept. Agr., Bur. Ent. Circ. 74, pp. 5, figs. 3*).—During the present season two broods of the periodical cicada will reappear, one being a 17-year brood and distributed from Illinois to Massachusetts and southward to Georgia. The other is the 13-year brood and is distributed in North Carolina, Georgia, Alabama, and Tennessee. Brief notes are given on the damage done by this pest. The broods are expected to appear about the last week in May.

Studies in grasshopper control, J. S. HUNTER (*California Sta. Bul. 170, pp. 28, figs. 17*).—During 1904, grasshoppers were very injurious in the San Joaquin Valley, where they hatched out in April or earlier and appeared in large numbers early in May. Various crops are raised on the infested ground, but in one locality the grasshoppers were found very injurious in an area of about 2,000 acres devoted to alfalfa. The species concerned in this outbreak are *Clinopleura melanopleura*, *Melanoplus uniformis*, *M. devastator*, and *Œdaleonotus enigma*.

In combating grasshoppers it was found possible to destroy the young insects by burning the grass where the ground was fairly well covered. The winged form were also destroyed by the same means if the work was done during cool nights. Considerable success was had in poisoning grasshoppers, not by the Criddle mixture, which was unsatisfactory, but by the use of a poison bait which contained 5 lbs. of arsenic in 40 lbs. of bran moistened with 2 gal. of molasses. Hopperdozers could not be used as effectively in orchards as in alfalfa fields. Occasionally good results could be obtained by smoking the grasshoppers out of the fields. Near Newman the injurious species was *Melanoplus differentialis*. This pest defoliated vineyards and orchard trees, eating the fruit.

The Hessian fly, F. M. WEBSTER (*U. S. Dept. Agr., Bur. Ent. Circ. 70, pp. 16, figs. 16*).—A general account is presented of this important insect of wheat with notes on its early history, appearance, stages, habits, distribution, food plants, and injuries.

There appears to be no variety of fly-proof wheat, although macaroni wheat is somewhat less injured than other kinds. The natural enemies of the pest are discussed, and notes are given on the various remedies which have been tried for this insect, late sowing, crop rotation, burning of stubble, destruction of volunteer wheat, use of fertilizers, preparation of the soil, and use of good seed. In preventing the attacks of the Hessian fly the author recommends that good seed should be sown in well-prepared soil after the larger part of the fall brood has made its appearance. In spring seeding it is believed that the earlier wheat is sown the less danger there will be from the Hessian fly.

Some insects affecting the production of red clover seed, F. M. WEBSTER (*U. S. Dept. Agr., Bur. Ent. Circ. 69, pp. 9, figs. 8*).—Particular attention is given in this circular to the clover-flower midge and clover-seed chalcis.

It is believed that the clover-flower midge does not really infest the seed but lays its eggs in the ovaries before fertilization has taken place. The clover-seed chalcis, however, lives in the seeds only. No insects like bumblebees are able to fertilize clover which has been infested with the clover-flower midge. This insect is described in all its stages and notes are given on its life history. It has been reported as quite common in England and occurs in this country wherever clover is grown.

The best methods of controlling it consist in cutting clover not later than the second week in June in fields where clover is grown without much admixture of timothy. This operation seems to destroy the larvæ of the midge and also to hasten the second blooming so that the flowers are too far advanced for infestation by the midge. In cases where clover and timothy are grown mixed, the same results may be obtained by pasturing clover in the spring so as to delay the flowering period.

The clover-seed chalcis is also described and notes are given on its life history. This pest attacks the seed of red and crimson clover and also alfalfa. It is distributed also from New England to California on the west, and south to Mississippi. Insect enemies capable of controlling the pest are not known. Remedies recommended for the clover-flower midge might apply to this insect, and it is also suggested to destroy scattering heads of clover together with the chaff and stems after hulling.

The clover root borer, F. M. WEBSTER (*U. S. Dept. Agr., Bur. Ent. Circ. 67, pp. 5, figs. 4*).—This insect is a native of Europe and has become generally established in the eastern States. It attracted attention in 1878 in New York and has gradually spread toward the Mississippi River.

The insect is described in its various stages and notes are given on its life history and food plants. There appears to be but one annual generation. It feeds on red clover and alfalfa as well as other species of clover. Infested clover plants sooner or later die as a result of the attack of this insect. Apparently the only successful way of combating the pest is summer fallowing as soon as the hay crop is removed.

The tobacco thrips and remedies to prevent "white veins" in wrapper tobacco, W. A. HOOKER (*U. S. Dept. Agr., Bur. Ent. Circ. 68, pp. 5, figs. 2*).—*Euthrips nicotianæ* was described in September, 1905. The insect injures shade-grown cigar-wrapper tobacco in Florida, Georgia, and Texas.

The removal of the sap from the lateral veins of the leaves causes white streaks when the leaves are cured. This is objectionable from the standpoint of the cigar maker and reduces their value about 50 per cent. The adult insect appears to pass the winter in the tobacco fields. They deposit their eggs in the tissues of the stem and leaves and the young larvæ feed on the under surface of the leaves and the adults feed upon the upper surface. In combating this species clean cultivation is recommended. The pest appears in oats and it is urged that this crop be not planted in the vicinity of tobacco fields.

As an insecticide application the author recommends the use of kerosene emulsion according to the formula 2 gal. of kerosene, 1 gal. of water, and ½ lb. of hard soap diluted to make 10 gal. A number of applications should be made while the plants are in the seed bed and later in the field about two applications a week may be required. The expense of such an application does not exceed $20 per acre.

Pea and bean beetles (*Bd. Agr. and Fisheries [London], Leaflet 150, pp. 4, figs. 2*).—Descriptive, economic, and biological notes are given on *Bruchus pisi* and *B. rufimanus.*

The turnip mud-beetle, R. S. MACDOUGALL (*Jour. Bd. Agr. [London], 12 (1905), No. 2, pp. 102–104, fig. 1*).—*Helophorus rugosus* is quite widely distributed throughout England and Scotland. It attacks turnips by eating the leaves and tunneling the leaf stalks and roots. The injury is done both by the beetle and larvæ. Rotation of crops is recommended in controlling this pest, together with the liberal use of fertilizers.

The use of bisulphid of carbon against wireworms (*Jour. Bd. Agr. [London], 12 (1905), No. 2, pp. 104, 105*).—It has been found that the character of the soil largely determines the rate at which the fumes of this gas diffuse from the point where it was injected into the soil. In using bisulphid of carbon against wireworms little benefit can be expected on very wet soils, and the application should be made before the damage from the wireworms is too far advanced, and moreover the bisulphid of carbon should not be allowed to come in contact with the roots of the plants.

Report of the State nursery inspector, H. T. FERNALD (*Agr. of Mass., 52 (1904), pp. 243–247*).—Of the pests which require the attention of the inspector in Massachusetts, San José scale, oyster-shell scale, gypsy moth, and brown-tail moth are the most important. Brief notes are also given on black knot and other fungus diseases.

Report on work done in 1903-4 in the control of San José scale and other dangerous insect and fungus pests (*West Virginia Sta., 1904, pp. 96, figs. 16*).—An account of nursery inspection during the year under report is given by W. E. Rumsey (pp. 7-15).

A tabulated list of West Virginia nurseries is presented, with notes on their condition. The work along the line of orchard inspection is discussed by W. E. Rumsey and T. E. Brooks. This account includes a statement regarding the distribution of San José scale in country districts and in towns, spray mixtures for use in controlling this insect, and a brief résumé of the principal fruit sections of the State. The report also contains an account of spraying melons in the Ohio River Valley, by F. E. Brooks, and plant diseases of the State, by J. L. Sheldon.

Report on work done in 1904-5 in the control of San José scale and other dangerous insect and fungus pests (*West Virginia Sta. [1905], pp. 60, pls. 7*).—In the report for this year considerable attention is given to the grape curculio, which is discussed by F. E. Brooks. The same author also discusses nut weevils in West Virginia.

The report also contains a special report of the bacteriologist, J. L. Sheldon, on various plant diseases; potato blight, by A. L. Post; other investigations on potatoes, by T. C. Johnson; and a study of combined insecticides and fungicides, by B. H. Hite and C. H. Howard. Brief notes are also given as usual in these reports on nursery and orchard inspection.

Some points in nursery inspection, E. A. Popenoe (*Industrialist, 32 (1906), No. 18, pp. 275-279*).—The San José scale was the chief cause of the present nursery inspection laws in Kansas. A brief account is given of the methods employed in inspecting the nurseries, with particular reference to the more serious insect and fungus diseases. It is believed that not all of these diseases are transmitted in nursery stock. Apple-tree borers are apparently seldom carried in young nursery stock.

The plum curculio, F. Johnson and A. A. Girault (*U. S. Dept. Agr., Bur. Ent. Circ. 73, pp. 10, figs. 5*).—The life history and habits of this pest are described in detail.

The insect attacks plums, cherries, peaches, nectarines, apricots, apples, and pears, and sometimes feeds upon the foliage after the fruit has been harvested. The method of the attack upon various fruits is described and notes are given on the natural enemies of the pest. One of the most extensively applied remedies for the insects consists in the use of some form of jarring trap. This method has been widely adopted in plum and peach orchards in the South and has proved very satisfactory. The pest may be destroyed by thorough spraying with arsenicals. For this purpose arsenate of lead may be used at the rate of 2 lbs. to 50 gal. of water, or Paris green at the rate of 1 lb. to 150 to 200 gal. of water.

The codling moth in Arizona, J. J. Thornber (*Arizona Sta. Rpt. 1905, p. 22*).—The codling moth has been known in Arizona for 2 years and in infested districts causes wormy apples to the extent of 30 to 40 per cent. No hope is held out that this insect may be eradicated in Arizona, but it is believed that its presence will have an indirect benefit in forcing orchardists to spray their trees more thoroughly.

Report of committee on gypsy moth, insects, and birds, A. Pratt et al. (*Agr. of Mass., 52 (1904), pp. 217-239*).—A brief review is presented of the condition of the infested region contrasting the conditions observed in 1899 and 1904 in various towns in the neighborhood of Boston. A few new colonies have appeared outside the area which was known to be infested in 1899. In general the insect has spread slowly in various directions and in the localities of long infestation the numbers of the pests have greatly increased.

The brown-tail moth in Maine, E. F. HITCHINGS (*Bul. Maine Dept. Agr., 4 (1905), No. 4, pp. 101-127, pls. 4*).—A copy is presented of considerable correspondence relating to the prevalence of the brown-tail moth in Maine.

The Pomological Society of the State succeeded in getting an appropriation of $5,000 for 1905 and 1906 for the purpose of combating the brown-tail moth. In accordance with the act passed by the legislature a State entomologist was appointed to devote his time to the suppression of this and other insect and fungus pests. A review is given of the present status of the brown-tail moth in Maine. In many localities rewards have been offered for the destruction of the nests of this insect, and data regarding the amounts of money thus expended are presented in a tabular form.

The life history of the brown-tail moth is described and notes are given on other insect pests, including apple aphis, woolly aphis, scurfy bark-louse, and strawberry weevil, as well as on nursery inspection.

The goat moth and the wood leopard moth, R. S. MACDOUGALL (*Jour. Bd. Agr. [London], 12 (1905), No. 2, pp 115-118, fig. 1*).—Notes are given on the habits and life history of *Cossus ligniperda* and *Zeuzera æsculi*. Small branches infested with the leopard moth should be removed and burned, and the same remedies should be applied to trees infested with goat moth. The goat moth may be prevented to some extent from laying its eggs by painting the lower part of the tree with soft soap, kerosene, or some other substance obnoxious to the insect.

Woolly aphis, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 407-409, figs. 4*).—This pest is difficult to control on the more susceptible varieties of apples. A list is presented of apple varieties which appear to be more or less resistant to woolly aphis. The aerial form of the pest may be controlled by the use of kerosene emulsion or by fumigation with hydrocyanic-acid gas.

Leaf hoppers and their natural enemies, R. C. L. PERKINS and G. W. KIRKALDY (*Hawaiian Sugar Planters' Sta., Div. Ent. Bul. 1, pts. 9, pp. 267-479, pls. 12; 10, pp. 483-499, pls. 6; introduction, pp. XXXII+501-508, figs. 7*).—In continuation of this series (E. S. R., 17, p. 783) the general anatomical characters of leaf hoppers are described by G. W. Kirkaldy, in part 9, with notes on the rapidity of their multiplication, other points in their life history, and their classification. In the study of this group in the Hawaiian Islands and elsewhere various new species have been discovered and of many of these descriptions are given. Notes are also presented on the relations between leaf hoppers and ants. A bibliography of literature relating to leaf hoppers is appended to the bulletin.

Part 10 is supplementary to part 1 (E. S. R., 17, p. 477), and deals with observations made in Australia and Fiji Islands and material collected in those countries. A number of new species of Dryinidæ and Pipunculidæ are described.

In the introduction by R. C. L. Perkins, which is the last part received, a general account is presented of the work done in Australia, Fiji Islands, and the United States, with particular reference to the methods of transporting and handling parasites and also to the effects of these parasites upon the leaf hoppers. A brief summary of the bulletin is added, together with an index.

The pepper weevil, A. MERAZ (*Com. Par. Agr. [Mexico], Circ. 33, pp. 4, fig. 1*).—Peppers are subject to the attacks of *Anthonomus eugenii*. This pest was studied by the author, with particular reference to practical methods for controlling it.

It is recommended that peppers should not be planted on soil cultivated to Indian corn during the previous year. The selection of seeds from fruits which have resisted the attack of the insect is desirable on account of the fact that they possibly possess some resisting power. Infested fruits should be collected and destroyed as soon as they are recognized. Rotation of crops is also recommended. Some benefit may be derived on spraying with arsenicals, especially arsenate of lead.

The habits, life history, and means of combating Agrostis segetum, K. Rossikov (*Trudui Byuro Ent.* [*St. Petersb.*], *6* (*1905*), *No. 5, pp. 120, pls. 4, figs. 37*).—An elaborate review is presented of the appearance, distribution, and life history of this cutworm. The author discusses the number of generations, the egg, larva, and other stages of the pest. Attention is given also to its insect parasites belonging to various orders, with reference also to fungus and bacterial diseases. In the discussion of methods for controlling the pest the subject is discussed under different heads, according to the stage of the insect concerned.

The larva of Plodia interpunctella, B. Wahl (*Ztschr. Landw. Versuchsw. Oesterr.*, *8* (*1905*), *No. 10, pp. 950–954*).—This pest was found in fig coffee and also in a number of other food products. The systematic position of the moth is briefly outlined, and detailed notes are given on the external anatomy of the caterpillar, with particular reference to the number and location of the bristles.

Parthenogenesis in Otiorrhynchus turca, A. A. Ssilantjew (*Zool. Anz.*, *29* (*1905*), *No. 18, pp. 583–586, figs. 2*).—In studying this insect which has recently caused great damage to grapes in the region of the Black Sea, the author observed that no males were to be found. Observations along this line showed that females taken immediately after emergence and kept confined in glass jars during their whole life laid eggs which were perfectly fertile and developed into normal individuals.

On the Cecidomyid forming the galls or pseudocones on Pinus longifolia, E. P. Stebbing (*Indian Forester*, *31* (*1905*), *No. 8, pp. 429–434, pl. 1*).—For some time galls have been noticed on this pine tree which so closely resembled the cones as to be mistaken for them. When examined by the author they were found to be due to a species of Cecidomyia, which is briefly described. Notes are also given on a parasitic insect found upon the gall insect.

A new enemy of the Douglas fir, R. S. Macdougall (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 10, pp. 615–621, figs. 4*).—*Megastigmus spermotrophus* was found infesting the seeds of Douglas fir.

This insect is described in its various stages. The eggs are laid in the young cones of the Douglas fir and each seed is infested by one larva. In preventing the destruction of cones by this pest it is recommended that after the seed is collected it should be subjected to treatment of bisulphid of carbon at the rate of 1 oz. for every 50 cu. ft. of air space.

Notes on termites with special reference to the destruction of timber by Calotermes brouni, T. Broun (*New Zeal. Dept. Agr. Ann. Rpt.*, *13* (*1905*), *pp. 430–436, pls. 2*).—It has been found that for railroad ties various woods may safely be used which would otherwise soon be destroyed by white ants. This is due to the fact that the ants are frightened away by the jar produced by passing trains.

Calotermes brouni is an exceedingly injurious species, and notes are given on its injury to various kinds of wood, especially Puriri and Kauri woods. The insect is described in its various stages.

Spraying apples. Relative merits of liquid and dust applications, C. S. Crandall (*Illinois Sta. Bul. 106, pp. 205–242, figs. 14*).—While a combination of Bordeaux mixture and arsenicals has long been known to give satisfactory results in the control of scab and some of the other common fungus diseases of apples, as well as codling moth and leaf-eating caterpillars, the method is somewhat extensive and various experiments have been made to test the economy of dust sprays.

The author's work along this line has been carried on for a period of 3 years, during which various plats of apple trees were sprayed or dusted from 3 to 8 times during the season, the first application being made just as the buds were opening. Particular attention was given during this series of experiments to the effect of treatment on apple scab, fruit blotch, codling moth, and curculio. It appears from these experiments that the pests just mentioned must be recognized as of a permanent nature and

that they require annual treatment in order to secure a good crop of clean fruit. The use of a dust spray considerably diminishes the cost and labor of spraying, but it is quite inefficient.

Trees sprayed with liquid Bordeaux mixture and Paris green retained their foliage through the season, while the foliage turned yellow and fell off from the trees treated with a dust mixture as readily as from the check trees. This loss of foliage is an important matter in the growth of the tree and indicates clearly that the dust method is not satisfactory. The dust spray is 52 per cent cheaper than the liquid spray but, according to the author, has no other advantages. It is, therefore, recommended that the orchardist spend his time and energy in perfecting his methods of preparation and application of Bordeaux mixtures combined with arsenicals.

In these experiments the formula used for the liquid Bordeaux mixture was 4 lbs. copper sulphate, 4 lbs. of lime, ¼ lb. Paris green per 50 gal. of water, and a proprietary form of Bordeaux and Paris green was used for the purpose of comparison.

Spraying, G. F. WARREN (*New Jersey Stas. Bul. 194, pp. 60*).—The purpose of the author was to combine in the present bulletin in a convenient form the various recommendations which have been made by the station in previous publications regarding the control of insects and fungus diseases. The bulletin constitutes a convenient summary of information on this subject and contains an account of the purpose of spraying, the methods to be adopted in spraying various fruit and garden crops, a spray calendar, formulas for the preparation of the more important fungicides and insecticides, and a discussion of spray pumps.

Spray calendar (*Vermont Sta. Spec. Bul., Apr., 1906, folio*).—Formulas are given for the preparation of lime-sulphur-salt wash, Paris green, Bordeaux mixture, Hellebore, and kerosene emulsion, and brief directions are given for the application of these remedies.

The preparation of emulsions of crude petroleum, T. M. PRICE (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 89, pp. 4*).—The ordinary kerosene emulsion is not well adapted for use as a dip or hand treatment for animals, since the oil does not remain emulsified and is distributed unevenly on the surface of the body.

Beaumont oil has been found by the Bureau to be an effective dip for destroying cattle ticks. There are certain objections to its use, however, particularly an occasional injury to cattle. Experiments were therefore made to secure an emulsion which would remain uniform for an indefinite period. This was accomplished by employing a formula calling for 2 gal. crude petroleum, ½ gal. water, and ½ lb. hard soap. The soap is dissolved in hot water and the crude petroleum is added and mixed with a spray pump, after which it is diluted with the desired amount of water.

An emulsion of crude petroleum made in this way remains fluid indefinitely without any tendency to a separation of oil and water. Brief directions are also given for the preparation of emulsions and other oils.

The fumigation of dwelling houses for vermin, C. FULLER (*Natal Agr. Jour. and Min. Rec., 8 (1905), No. 5, pp. 457–464, fig. 1*).—Directions are given for the use of hydrocyanic-acid gas in destroying bedbugs, cockroaches, and other insects in houses. For large rooms several generators may be arranged, and care should be exercised to prevent one of them from being set in operation before the others if the attendant is still in the room. It is recommended that the period of fumigation be 6 to 8 hours if possible, but never less than 3 hours.

Key to the known larvæ of the mosquitoes of the United States, H. G. DYAR (*U. S. Dept. Agr., Bur. Ent. Circ. 72, pp. 6, fig. 1*).—This circular contains an analytical key intended for use in the identification of the known larvæ of mosquitoes.

House flies, L. O. HOWARD (*U. S. Dept. Agr., Bur. Ent. Circ. 71, pp. 9, figs. 9*).—This is a revision of Circular 35 (E. S. R., 10, p. 654).

The distribution of tsetse flies in French East Africa and in Kongo, A. LAVERAN (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 23, pp. 929–932*).—Brief

notes are given on the distribution of various species of Glossina and Tabanus in Senegal, French Kongo, New Anvers, the district of Ubangi, and other neighboring countries.

The horse botfly (*Jour. Bd. Agr. [London], 12 (1905), No. 2, pp. 108-110, figs. 2*).—The botfly is quite common in the central and southern part of England, but almost entirely absent from the northern part of the country. The common species observed in England is *Gastrophilus equi*, but it is considered desirable that the point should be determined whether other species also occur.

Observations on the bionomics of Auchmeromyia leuteola, F. C. WELLMAN (*Ent. News, 17 (1906), No. 2, pp. 64-67, figs. 3*).—The larvæ of this fly is a blood-sucking maggot which has previously been referred to from South Africa. The author followed the complete life history of the species and gives notes on its method of attacking man.

Anatomy of Boophilus annulatus, S. R. WILLIAMS (*Proc. Boston Soc. Nat. Hist., 32, No. 8, pp. 313-334, pls. 5, figs. 3*).—The external anatomy, habits, and life history of the cattle tick have been quite thoroughly worked out. The present article, however, is apparently the first attempt to describe in detail the various features of the internal anatomy of the cattle tick.

It appears that the internal anatomy of this pest differs decidedly from that of *Ixodes ricinus* described in 1861 by Pagenstecher. In order to study the internal anatomy of cattle ticks it was found necessary to allow the body to shrink somewhat in alcohol. This makes it possible to remove the chitin which otherwise interferes with making sections. According to the author, the external porous areas on cattle ticks are sense organs. The alimentary canal is a slightly curved tube provided with 6 large diverticula, which occupy most of the body of the tick. The adult females appear to eject nothing from the alimentary canal or the renal organs.

Apiculture, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 403-405, pls. 4*).—On account of the growing importance of the bee industry in New Zealand, it is recommended that an efficient expert be appointed for the purpose of giving instruction to bee raisers. The author has inspected about 2,500 colonies of bees, and brief notes are presented on foul brood, bee moth, and other troubles which affect the bee raiser.

Beekeeping: How to meet its dangers and difficulties, B. N. GATES (*Agr. of Mass., 52 (1904), pp. 411-426*).—Statistics are given on the amount of honey produced in Massachusetts and certain other States with which Massachusetts is compared. In wintering bees it is essential that the colonies have plenty of stores and be given a uniform temperature, without too much moisture. Particular attention is given to the discussion of the bee moth, robbing, foul brood, and other diseases of bees.

Scientific queen raising, A. H. W. CLARKSON (*Queensland Agr. Jour., 16 (1905), No. 1, pp. 118-122*).—The author argues that it is useless to attempt to rear queens in weak colonies. The nuclei should be strong, since otherwise the necessary amount of food and the proper temperature can not be secured for the development of queens. As a standard for good queens it is considered that they should be able to lay from 2,000 to 3,000 eggs per day during the proper season of the year.

The method recommended by the author consists in transferring a frame of queen cells with royal jelly to a strong colony of bees which, at the time, is working vigorously in the upper part of the hive. Before this is done a couple of frames containing young larvæ could be removed from the lower to the upper story and a queen placed between the bottom and top story. As soon as the bees find that the brood is not increasing in the top story they proceed to raise a new queen.

Ventilation of bees, DEVAUCHELLE (*Apiculteur, 50 (1906), No. 1, pp. 10-14*).—The author presents a discussion of the phenomenon of bees ventilating the hive by wing movements at the entrance to the hive. It is believed that the purpose of this is to lower the temperature in the hive and renew the air in order to increase the evaporation of nectar.

Bees and the color of flowers, G. BONNIER (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 24, pp. 988–994*).—After carrying on numerous observations with regard to the attraction of the color of flowers for bees, the author comes to the conclusion that the color of flowers does not exercise any apparent influence upon the worker bee.

Catalogue of the exhibit of economic entomology at the Lewis and Clark Centennial Exposition, Portland, Oregon, 1905, R. P. CURRIE (*U. S. Dept. Agr., Bur. Ent. Bul. 53, pp. 127*).—This catalogue was designed to increase the usefulness of the exhibit of the Bureau of Entomology in Portland by furnishing information regarding the insects contained in that exhibit. The species represented were largely the same as those shown at the St. Louis Fair, but some insects of interest only to eastern localities were omitted.

FOODS—HUMAN NUTRITION.

Standards of purity for food products (*U. S. Dept. Agr., Office Sec. Circ. 17, pp. 7*).—The food materials for which standards are proposed include dried, evaporated, canned, and preserved fruits and similar products, flavoring extracts, oils used in the preparation of extracts, olive oil, cotton-seed oil, and other edible vegetable oils, and table salt.

A flavoring extract is defined as "a solution in ethyl alcohol of proper strength of the sapid and odorous principles derived from an aromatic plant, or parts of the plant, with or without its coloring matter, and conforms in name to the plant used in its preparation."

The various flavoring extracts described are intended solely for food purposes and, it is pointed out, are not to be confounded with similar preparations described in the Pharmacopœia for medicinal purposes.

This publication supplements a circular previously noted (E. S. R., 16, p. 894).

Legislation regulating the sale of foods (*Rev. Soc. Sci. Hyg. Aliment., 2* (*1905*), *No. 6, pp. 467–640*).—A summary of laws regarding the regulation of foods, previously noted, is continued (E. S. R., 17, p. 59). The present installment includes Holland, Spain, Portugal, Sweden, Denmark, France, and the United States.

The microscopy of vegetable foods, A. L. WINTON (*New York: John Wiley & Sons; London: Chapman & Hall, Ltd., 1906, pp. XVI + 701, figs. 589*).—This volume, which was prepared with the collaboration of J. Moeller, summarizes the results of a large number of original investigations on the histology of products of vegetable origin, and is designed for the use of food analysts, agricultural chemists, pharmacists, and others engaged in the examination of foods, as well as the physician who may be called upon to identify vegetable substances in stomach contents and feces.

It has been the author's aim to make the volume comprehensive and to have it cover the important vegetable foods used by man and domestic animals, and to present the material in such form that it will be available for ready reference. In preparing the work the author states that leading authorities have been consulted and "credit has frequently been given for important discoveries, although so far as possible the writer has based his descriptions on his own observations." Laboratory equipment, methods, and general principles relating to the microscopical examination of vegetable food products are discussed.

The materials described and illustrated include grain and its products and impurities, oil seeds and oil cakes, legumes, nuts, fruit and fruit products, vegetables, alkaloidal products and their substitutes, spices and condiments, and commercial starches. The illustrations, very many of them from original drawings, are a special feature of the volume and add much to its value. A bibliography, glossary, and index are included. The volume as a whole is an important contribution to the subject of vegetable histology, which, both as a pure and applied science, has hitherto been taken up almost exclusively by European investigators.

Food products, A. L. WINTON ET AL. (*Connecticut State Sta. Rpt. 1905, pt. 2, pp. 107-144*).—Under the provisions of the State pure-food law 1,347 samples of milk, olive oil and substitutes, coffee, spices, chocolate, candies, jams, extracts, and similar products were examined, over half of the samples being collected by the station and the remainder submitted by the dairy commissioners and by health officers, consumers, and dealers. Of these samples 388 were adulterated or below the standard, 94 were compounds, while the remaining 865 were not found to be adulterated.

Cereal breakfast foods, C. D. WOODS and H. SNYDER (*U. S. Dept. Agr., Farmers' Bul. 249, pp. 36*).—The results of investigations carried on at a number of experiment stations on the digestibility and nutritive value of cereal breakfast foods are summarized, as well as general information on this important class of food products. Some of the questions discussed are the preparation of modern cereal breakfast foods, predigested and malted goods, cooking, the absorption of water by different cereals and their solubility, cost of cereal breakfast foods as compared with other foods, and the place of these foods in the diet. Information regarding the use of cereal products as coffee substitutes is also summarized.

"In the selection of cereal breakfast foods the consumer may be guided by the results of analyses of disinterested chemists, by the digestibility as determined by actual tests, by cost, by taste, by economy, or by the observed effects of the goods upon individuals. It seems fair to conclude that the chemical composition, considered in connection with digestibility and cost, furnishes a satisfactory guide for selection, due attention being paid to palatability and individual preferences.

"All things considered the cereal breakfast foods as a class are nutritious, convenient, and reasonably economical foods and worthy of an important place in the diet when judiciously combined with other foods."

Food and the principles of dietetics, R. HUTCHISON (*London: Edward Arnold, 1906, pp. 582; rev. in Brit. Med. Jour., 1906, No. 2362, p. 806*).—This handbook has been revised and some new material added, including among other topics a discussion of underfeeding.

Unpolished rice, H. S. CLUBB (*Philadelphia: Vegetarian Society of America, 1905, pp. 32*).—On account of its higher protein content the use of unpolished instead of polished rice is advocated. In addition to discussing the various topics connected with the use of rice in the diet the author has summarized a large number of recipes for preparing it for the table.

The digestibility of flour made from legumes, M. WINTGEN (*Veröffentl. Mil. Sanitätsw., 1905, No. 29, pp. 37-55; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 4, pp. 225, 226*).—Artificial and natural digestion experiments with pea meal, bean meal, and lentil meal are reported. As shown by the experiments with man the pea meal was more digestible than the other sorts studied.

Preserved eggs and egg substitutes, A. BEYTHIEN and L. WATERS (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 5, pp. 272-274*).—Data are reported regarding the composition of egg powders and similar goods.

Chemical change produced in foods, etc. (*Pure Products, 2 (1906), Nos. 2, pp. 70-72; 3, pp. 118-120*).—A summary of data regarding the chemical changes due to micro-organisms, etc., which take place when food of different sorts is stored or preserved in different ways.

Preserved fruits in lacquered tins (*Lancet [London], 1906, I, No. 8, pp. 529, 530*).—Examination of fruits in tin cans with the interior surface lacquered showed that this method of treating the can prevented metallic contamination.

A number of experiments were made with this method of canning, using raspberries, strawberries, gooseberries, plums, blackberries, greengages, and damsons. "In no instance was there the least indication of any action on the tin and not a trace of tin could be found in the sirup, while the color of the fruit was satisfactorily preserved."

Pure British dried vegetables (*Lancet [London], 1906, I, No. 11, p. 766*).—Commercial dried or evaporated vegetables are described, which are regarded as of good quality. It is stated that the condition of the food constituents was not changed by evaporation, the albumins of the dried product being still soluble. Color and freshness of flavor, it is stated, were also little affected.

The occurrence of esters in bananas, F. ROTHENBACH and L. EBERLEIN (*Deut. Essigindus., 1905, No. 9, pp. 81, 82; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 4, pp. 230, 231*).—The authors report isovaleric-isoamyl ester and ethyl ester in bananas. The possible occurrence of amyl acetate is also noted. Experiments showed that ester formation did not depend upon micro-organisms, but was a product of cell activity.

Commercial extract of lemon, A. MCGILL (*Lab. Inland Rev. Dept. [Canada], Bul. 114, pp. 15*).—Considerable range in alcohol strength and in lemon oil content was noted. Of the 110 samples examined, 2 contained 6 per cent or more of lemon oil and 78 less than 1 per cent. No methyl alcohol was found.

Coffees without caffein, G. BERTRAND (*Compt. Rend. Acad. Sci. [Paris], 141 (1905), No. 3, pp. 209–211*).—According to the author's analyses, the berries of *Coffea gallienii, C. bonnieri, C. mogeneti,* and *C. humblotiana* contain no caffein. The ash, water, and total nitrogen in the samples were also determined. A sample of *C. mauritiana* contained only a very small percentage of caffein, namely, 0.7 gm. per kilogram. A sample of *C. arabica*, analyzed at the same time, showed 13.4 gm. caffein per kilogram.

Maple sugar and sirup, W. F. HUBBARD (*U. S. Dept. Agr., Farmers' Bul. 252, pp. 36, figs. 9*).—This bulletin is based on a publication of the Bureau of Forestry previously noted (E. S. R., 17, pp. 774, 790).

Physiological studies of vegetarian diet, W. CASPARI (*Arch. Physiol. [Pflüger], 109 (1905), No. 11–12, pp. 473–595, pls. 3*).—Extended studies are reported of vegetarian and raw fruitarian diet. In connection with this work studies were made of the metabolism of nitrogen, the digestibility of the diet, and the effect of the food on the respiratory quotient. Two of the subjects were professional athletes, one a vegetarian, the other not. The general conclusions drawn were in effect as follows:

A strictly vegetable diet, even when made up of raw foods, is able to nourish the body in youth and maintain it at the highest degree of physical strength and mental and physical power, yet this sort of diet is considered unsatisfactory because the nutrients, particularly protein, are not well assimilated because the food is lacking in flavor and is of large volume. The vegetarian diet when made up of ordinary vegetables, fruits, etc., has an advantage in that it is not expensive.

It did not appear that the vegetarian diet surpassed the ordinary diet on account of the small amount of uric acid formed. As is commonly claimed the amount of purin bodies formed was small as compared with the quantity obtained with an excessive meat diet and under certain pathological conditions. As regards the performance of muscular work the vegetarian diet certainly is not superior to the ordinary mixed diet.

A respiration calorimeter with appliances for the direct determination of oxygen, W. O. ATWATER and F. G. BENEDICT (*Washington, D. C.: Carnegie Institution of Washington, 1905, pp. X+193, figs. 49*).—This volume includes a detailed description of a respiration calorimeter and accessory apparatus which the authors have devised for experiments with man, together with the results of check experiments to determine the accuracy of the apparatus and an experiment with man.

The respiration calorimeter has been in process of development for 12 years, and much of the work connected with it has been a part of the cooperative nutrition investigations of the Department of Agriculture and reported in Department publications (E. S. R., 15, p. 698; 17, p. 165). Under the auspices of the Carnegie Institu-

tion very important changes in the apparatus have been introduced and the method of experimenting has been modified to include the direct determination of oxygen. A quantity of air circulates through the apparatus and the carbon dioxid and water eliminated in the respiratory products are removed by passing the air current through soda-lime mixture and through sulphuric acid. As the air current passes back into the respiration chamber oxygen is added to make up for that used by the subject, the amount being determined by weighing the cylinder containing the oxygen before and after the addition is made.

The calorimeter may be fairly designated an instrument of precision and serves for the very accurate measurement of energy, carbon dioxid, water, and oxygen in experiments with man extending over a number of days, under various conditions of work and rest.

In connection with the experiments, the balance of income and outgo of nitrogen and other food constituents is taken into account so that the experiments furnish data for considering the total income and outgo of matter and energy in addition to the respiratory quotient.

"In experiments with man as carried out with this apparatus and accessories, the following determinations of intake and output of material are made:

"The intake [as regards matter] consists of food, drink, and oxygen from respired air. The amounts are determined by weighing. The analyses include determinations of water, ash, nitrogen, carbon, hydrogen (organic), and at times sulphur and phosphorus. The output of material consists of products of respiration and perspiration, urine, and feces. The dry matter of feces and urine is subjected to a series of analyses similar to those for food, and the water and carbon dioxid of perspiration and respiration are determined according to the methods discussed in this report. The determinations of nitrogen in perspiration are made, when necessary. . . .

"[In the case of energy] the intake is derived from the potential energy, i. e., heats of combustion of the food. The output consists of sensible heat given off from the body, the latent heat of the water vaporized, and the potential energy, i. e., heat of combustion of the unoxidized portions of the dry matter of urine and feces. In certain cases, e. g., work experiments, a not inconsiderable portion of the output is in the heat equivalent of external muscular work. . . .

"The heats of oxidation are determined by burning the substances in the bomb calorimeter; the heat given off from the body is measured by the respiration calorimeter; the external work is measured by a specially devised ergometer. Allowance is made for heat introduced and removed by the ventilating air current, food, feces, and urine, and for that involved in changes of body temperature, which is also measured. . . .

"Since the completion of the new apparatus, 22 experiments with 5 different subjects, covering a total of 60 days, have been conducted. These experiments lasted from 1 to 13 days, during which time the subject remained inclosed in the calorimeter chamber. Ordinarily the experiment lasts 3 or 4 days. In general, each experiment is preceded by a preliminary period outside the chamber, during which the subject is given the special diet to be tested, and his habits of life so modified as to conform with those to be followed in the chamber. When the subject is to be engaged in muscular work, he devotes considerable time in the preliminary days to riding a bicycle in the open air, the amount of work performed being as nearly as can be judged equivalent to that to be done later on the bicycle ergometer inside the chamber.

"The food for the whole experimental period, including the preliminary days, is carefully weighed, sampled, and daily portions placed in proper containers ready for consumption. The more easily decomposed materials, such as milk and cream, are sampled, weighed, and analyzed each day. The bread and meat when used are

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carefully sterilized in glass jars. The diet may be so planned as to maintain a uniform quantity of nitrogen and a constant calorific value from day to day."

Respiratory quotient in static work, II, A. BORNSTEIN and A. OTT (*Arch. Physiol. [Pflüger], 109 (1905), No. 11-12, pp. 621-627*).—On an average of 17 experiments it was found that the work required in standing was equivalent to 156 calories per minute. Data are also given regarding the expenditure of energy when a pack was carried on the back.

Respiratory quotient in static work, III, A. BORNSTEIN and B. VON GARTZEN (*Arch. Physiol. [Pflüger], 109 (1905), No. 11-12, pp. 628-633*).—The data reported have to do with the effect of weighting the chest on the oxygen consumed and the carbon dioxid excreted.

Alcohol, sugar, and caffein, and their effect upon muscular work, I. IOTEYKO (*Rev. Soc. Sci. Hyg. Aliment., 2 (1905), No. 5, pp. 483-491, fig. 1*).—From experiments in which musular work was measured with an ergograph, the conclusion was reached that sugar is an excellent food, a direct source of energy in the muscles, and not an excitant. Caffein is considered as an excitant of the nervous system and, in the author's opinion, is of great importance as a tonic, though it has probably no nutritive value.

The after effect of muscular work upon water vapor secretion, H. WOLPERT and F. PETERS (*Arch. Hyg., 55 (1906), No. 3, pp. 309-322*).—The increased excretion of water vapor due to muscular work can be noted for several hours after the work has ceased.

The daily curve of water vapor excretion in man, H. WOLPERT and F. PETERS (*Arch. Hyg., 55 (1906), No. 3, pp. 299-308, dgm. 1*).—From their investigations the authors conclude that neither the time of day nor the diet is a direct cause of variation in the amount of water vapor excreted. The average amount excreted per day was 1,650 gm. at, in still air, a temperature of 24° C. and containing 65 per cent moisture.

Observations on creatin excretion in man, C. J. C. VAN HOOGENHUYZE and H. VERPLOEGH (*Ztschr. Physiol. Chem., 46 (1905), No. 5-6, pp. 415-471, figs. 8*).—In the experiments reported muscular work did not exercise any marked effect on the excretion of creatin except in the case of a fasting subject, when an increase was noticeable. Gelatin and casein added to the ration did not increase creatin excretion, and the addition of 5 eggs caused only a slight increase. Other questions relating to creatin formation and excretion were also studied and the investigation as a whole is discussed with reference to Folin's theory of nitrogen metabolism.

Report of the departmental committee on vagrancy, J. L. WHARTON ET AL. (*London: Wyman & Sons, Ltd., 1906, pp. VI + 123*).—The housing, care, and management of vagrants, and their relation toward other classes are considered, one of the questions taken up being the dietary for casual wards and labor colonies. The dietary recommended for casual wards would cost about 39 cts. per head per week and would furnish 63 gm. protein and 2,500 calories per head per day, and that recommended for labor colonies would cost about 33 cts. per head per week and furnish 66 gm. protein and 2,236 calories per head per day.

ANIMAL PRODUCTION.

Commercial feeding stuffs, E. H. JENKINS and A. L. WINTON (*Connecticut State Sta. Rpt. 1905, pt. 3, pp. 145-188*).—The feeding stuffs examined under the State law included cotton-seed meal, linseed meal, rape-seed meal, wheat bran, wheat middlings, wheat mixed feed, maize meal, gluten meal and feed, hominy feed, rye feed, malt sprouts, dried distillery grains, buckwheat middlings, alfalfa meal, miscellaneous mixed feeds, proprietary horse feeds, proprietary and other dairy and stock feeds, proprietary poultry feeds, beef scrap, and meat meal.

"The examinations of these feeds show that in many cases the dealers do not give the guaranties, as required by law. When given, they are too often misleading, being much higher than the composition of the goods warrants. This is especially noticeable in the gluten meals and gluten feeds.

"The mixtures of wheat feed and corncobs, formerly sold, illegally, as 'wheat feed,' are now sold under distinctive names and with a guaranty; thus complying with the law.

"There are still on the market a large number of low-grade mixed feeds, of very moderate feeding value, but sold for only a few dollars per ton less than the standard high-grade feeds."

In most cases a feeder can not use to advantage any boughten feed containing less than 15 per cent of protein.

"Ready-mixed feeds, made of a number of by-products or factory wastes, may wisely be let alone, unless the buyer can see for himself out of just what raw material the mixture is being prepared. Low grade, damaged corn, shriveled wheat, peanut refuse and wheat screenings containing many weed seeds, are not infrequently found in such feeds by careful examination, but are not easy for the buyer himself to recognize."

Commercial feeding stuffs sold in Maryland, H. B. McDonnell et al. (*Md. Agr. Col. Quart., 1905, No. 30, pp. 7*).—The protein and fat were determined under the State feeding-stuff law in a number of samples of meat meal and other poultry feeds of animal origin, cotton-seed meal, linseed meal, unpressed flaxseed meal, gluten feed, molasses grains, wheat middlings, alfalfa meal, short-cut alfalfa, dried distillers' grains, wheat bran, wheat middlings, proprietary poultry feeds, pigeon feed, ground oats, sugar-beet pulp feeds, corn bran, and mixed and proprietary feeds. "We have reason to believe that ground peanut hulls are being used to some extent to adulterate feeds, probably bran, and purchasers should be on the lookout for this, as the hulls are worthless as a feed."

Concentrated feeding stuffs, J. P. Street, W. P. Allen, and V. J. Carberry (*New Jersey Stas. Bul. 193, pp. 38*).—The feeding stuffs examined under the State pure-food law included cotton-seed meal, linseed meal (old process), germ meal, gluten feed, corn bran, hominy meal and similar goods, distillers' and brewers' grains, malt sprouts, molasses grains, mixed and proprietary feeds, biscuit refuse, biscuit refuse and milk, alfalfa meal, barley feed, dried sugar beet pulp, meat meal and proprietary poultry feeds, calf meal, wheat bran, wheat middlings, feeding flour, wheat feed, rye bran, rye feed, corn meal, corn-and-cob meal, mixed ground grains, buckwheat middlings, buckwheat bran, and buckwheat feed.

"Of the 125 different brands of feed received, and which should have been guaranteed, four failed to meet this requirement.

"Of the 241 samples which were guaranteed, 90 were deficient, 71 of these being low in protein.

"Of the 103 samples which did not require a guarantee, all were pure products, but the wheat brans and feeding flours were below normal quality.

"No direct adulteration is reported, but there are a number of feeds on the market whose composition does not warrant the high guarantees they carry.

"The purchaser of protein will rarely find any feed containing less than 15 per cent of protein a desirable or an economical purchase, and in all cases a strict regard must be given to the amount of nutrients guaranteed and the prices asked for the same."

Third report on concentrated feeding stuffs and cotton-seed meal, B. W. Kilgore, C. D. Harris, and J. C. Phelps (*Bul. N. C. Dept. Agr., 26 (1905), No. 11, pp. 63, figs. 7*).—Under the provisions of the State feeding-stuff law 534 samples of wheat bran, wheat middlings, bran and shorts, ship stuff, oat feeds, corn and oat feeds, rice meal, rice feed, peanut bran, peanut feed, molasses or sugar feeds, malt sprouts, gluten feed, hominy feeds and chops, cotton-seed meal, cotton-seed hulls, cotton-seed feeds, and mixed and proprietary feeds.

About one-third of the samples of wheat bran were found to contain corn bran, rice chaff, and peanut shells. One-third of the samples of bran and shorts were also found to be mixtures. In the case of corn and oat feeds, molasses feeds, hominy feeds, cotton-seed feeds, and mixed and proprietary feeds most of the samples were of good quality. In the case of other classes of goods analyzed a larger proportion of the goods were below the standard. "Good grades of cotton-seed meal contain 43 per cent or more of protein. This means that they have about 7 per cent of nitrogen, which is equal to 8.5 per cent of ammonia. Meals in past years especially have not infrequently been considerably higher than this." Of the 120 samples examined 37 were below the standard, 7.5 per cent ammonia.

Commercial feeding stuffs, J. L. Hills, C. H. Jones, and F. M. Hollister (*Vermont Sta. Bul. 117, pp. 8*).—Some 150 samples of commercial feeding stuffs were collected for examination under the State law in the spring of 1905. These included cotton-seed meal, linseed meal, gluten meals and feeds, distillers' dried grains, oat feeds, corn and oat feeds, hominy feed, sugar feed, ground beef scraps, wheat offals, and provenders.

Commercial feeding stuffs, J. L. Hills and C. H. Jones (*Vermont Sta. Bul. 118, pp. 9–16*).—In the autumn of 1905, 270 samples of commercial feeding stuffs were collected for inspection under the State law, including cotton-seed meal, linseed meal, gluten meals and feeds, distillers' dried grains, oat feeds, corn and oat feeds and similar goods, hominy feeds, mixed feeds, molasses grains, molasses beet pulp, alfalfa meal, calf meal, provenders, and wheat offals. The cotton-seed meals contained 41.5 per cent protein as compared with 44 per cent found in the samples on sale in the State up to a year or two ago. A low protein content has been observed elsewhere and has been attributed to general crop conditions.

Olive pomace as a feeding stuff, E. Marchi (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 163–172*).—From a study of the composition of olive pulp and a summary of data regarding its feeding value, the conclusion is reached that this material can be used in the feeding of farm animals, but that it should be mixed with some material which is low in fat and carbohydrates, such as legumes, commercial by-products, skim milk, casein, dried blood, etc.

Adulteration of feeding stuffs, C. Gotusso (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 205–209*).—Work connected with feeding-stuff inspection in Italy is spoken of. The author believes that chemical analysis furnishes a satisfactory basis for such work.

Alfalfa for the growing and fattening of animals in the Great Plains region, I. D. Graham (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 86, pp. 242–267*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 686).

The effect of the ration on the value of the manure, J. M. Bartlett (*Maine Sta. Bul. 126, pp. 45–48*).—In digestion experiments with steers the potash and phosphoric acid in the excretory products were determined, as well as the nitrogen. The rations were made up of hay alone and with spring and winter wheat bran and cotton-seed meal. The following table summarizes the values found:

The money value of the fertilizing elements excreted on each ration and per 100 lbs. of each feed.

Ration.	Nitrogen.	Phosphoric acid.	Potash.	Total value.
	Cents	*Cents.*	*Cents.*	*Cents.*
Hay alone	5.36	0.39	2.98	8.63
Hay and spring wheat bran	10.40	2.03	3.95	16.38
Hay and winter wheat bran	9.52	1.67	3.70	14.89
Hay and cottonseed meal	15.30	1.32	3.95	20.57
100 lbs. hay	13.50	.98	7.45	21.93
100 lbs. spring wheat bran	37.80	11.91	8.93	58.64
100 lbs. winter wheat bran	31.90	8.85	7.27	48.02
100 lbs. cottonseed meal	99 40	9.30	9.60	118.30

"In the first experiment with hay alone, more nitrogen was found in the excretions than was taken in the food. This discrepancy was probably due to insufficient nitrogen in the ration to maintain the animals and they lost flesh, excreting some body nitrogen. . . .

"The larger part of the nitrogen, the most expensive element, and potash are given off in the urine, hence the importance of saving all of this most valuable part of the manure. Not only are other elements found in large quantities in the liquid, but they are in much more available form than in the solid. Only traces of phosphoric acid were found in the urine."

The nitrogen balance in the nutrition of ruminants, A. GOUIN and P. ANDOUARD (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 122-124*).—Data are reported regarding the proportion of nitrogen excreted in the urine and feces. The authors believe that such data should be used with caution, especially when it is remembered that the food material remains a long time in the digestive tract of Herbivora.

Concerning the assimilation of protein in the animal body, E. ABDERHALDEN and F. SAMUELY (*Ztschr. Physiol. Chem., 46 (1905), No. 1-2, pp. 193-200*).—The examination of the blood of horses under different conditions showed that the protein of food was without influence on the composition of serum proteid.

The nutritive value of amids, B. VON STRUSIEWICZ (*Ztschr. Biol., 47 (1905), p. 143*).—From experiments with sheep the author concludes that amids have the same value as proteids, a deduction not in accord with the consensus of opinion of other investigators.

Phosphates in the ration of young animals, RASQUIN (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 62-68*).—The work of other investigators is summarized and tests briefly reported in which rations with and without added phosphate (ground bone) were studied with chickens. On a powdered bone ration the gain in weight was greater and the skeleton was heavier and contained a larger amount of lime and phosphoric acid. Mineral phosphates, the author concludes, are of value in the feeding of young animals.

Watering farm animals, P. WERY (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 86-91*).—Various questions concerned with the wholesomeness of the water supply are taken up. The author recommends that more public watering troughs be provided which will give a constant supply of water of good quality.

Proceedings of Second International Congress for the Rational Feeding of Farm Animals (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Compt. Rend., pp. 192*).—The programmes, list of members, proceedings, etc., of the Second International Congress for the Rational Feeding of Farm Animals, which was held in 1905 at the Universal Exposition at Liège.

Résumé of the principal experiments on cattle feeding which have been carried on in the low countries, J. J. O. DE VRIES (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 149-162*).—Dutch investigations on cattle feeding are summarized. The author believes that rations which have given satisfactory results in practice should be studied by scientific methods.

Feeding experiments with cattle designed for fattening and pasture, L. BAUWENS (*2. Cong. Internat. Aliment Ration. Bétail, 1905, Raps., pp. 144-148*).—Belgian studies are summarized comparing horse beans with and without other concentrated feed for young cattle, but conclusions are not drawn.

. **Experiments on fattening calves,** F. SMEYERS (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 197-204*).—The tests reported show that feeding whole milk to calves is not profitable.

Data are summarized regarding skim milk supplemented by other feeds, and attention is directed to the bad results which were obtained in the feeding of sour milk. The author believes that the question of the better utilization of skim milk

should be studied and that the degree of acidity which may be permitted without harm should be determined.

Cost of maintenance and growth of ruminants, A. GOUIN and P. ANDOUARD (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 115-121*).—On the basis of experimental evidence, the authors conclude that the energy required for a kilogram of gain in body weight is about 1,200 calories per square meter surface area. Powdered bone is considered an important aid in practical feeding.

Western feeds for beef production, J. G. HANEY and O. H. ELLING (*Kansas Sta. Bul. 132, pp. 21-52, figs. 9*).—Using 64 grade Shorthorn and Hereford cattle divided into 8 uniform lots, the value of corn-and-cob meal and Kafir corn meal with alfalfa hay, with Kafir corn hay, and with sorghum hay was studied, as well as ground wheat with alfalfa hay, and a mixed ration containing all the other feeding stuffs enumerated.

The greatest gain in the 152 days of the test, 338 lbs., was noted with the lot fed corn-and-cob meal and alfalfa hay, and the smallest gain, 160 lbs., with the lot fed ground Kafir corn and sorghum hay. Generally speaking, the lots fed the rations containing alfalfa hay and the mixed ration made larger gains than the other lots.

The cost of a pound of gain ranged from 5.13 cts. with the corn-and-cob meal and alfalfa hay ration to 11.74 cts. on ground Kafir corn and sorghum hay.

In the case of the lots fed ground grain and alfalfa hay the dressed weight was on an average 60 per cent of the live weight in round numbers. In the case of the other lots it was somewhat lower. Other data regarding the slaughter test are recorded.

"For beef production, ground Kafir corn is about equal, pound for pound, to corn-and-cob meal when alfalfa hay is fed with either of these concentrates. . . . Ground wheat and alfalfa hay, fed together, is not an economical ration for beef on account of the loosening effect of these feeds on the steers and the expensiveness of the wheat. . . .

"A matter of this experiment of considerable interest, especially to the western farmer, is the part that the various roughages play in beef production. . . . One bushel of corn-and-cob meal fed with alfalfa hay as roughage produced 11.8 lbs. of flesh, while the same amount of corn-and-cob meal fed with sorghum hay as a roughage gave in return only 6.25 lbs. of flesh; thus, a difference of 5.5 lbs., or 88 per cent in favor of the alfalfa hay ration. . . .

"It is the opinion of the writer that the western feeds grown without irrigation have the chief food constituents in a slightly different proportion from those grown under more favorable conditions, though the nutritive ratio of the rations fed and the profit per steer have a direct relation to each other. For practical work the results would be little changed by this difference in composition."

Highland cattle, J. ROBERTS (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 88, pp. 227-241*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 689).

Pigs and bacon (*Jour. Jamaica Agr. Soc., 10 (1906), No. 3, pp. 108-110*).—Data are summarized showing that bacon curing may be profitably carried on in Jamaica with local-grown pigs. The majority of the local feeding stuffs, it is pointed out, are very rich in carbohydrates and tend to produce fat rather than flesh. The pulp remaining after cotton-seed oil is expressed, peas, and cowpeas are spoken of as very satisfactory feeds for pigs raised for bacon.

Feeding of horses, E. LAVALARD (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 13-27*).—A summary and discussion of recent horse-feeding experiments in France, particularly those carried on upon a large scale.

Influence of foods containing sugar upon the digestibility of rations of horses, J. ALQUIER (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 1-12*).—On the basis of experimental evidence it is stated that sugar did not appreciably affect the digestibility of the nutrients of a ration even when as much as 5 or 6 kg.

per 1,000 kg. body weight was consumed. Sirup and molasses in smaller quantities, however, decreased digestibility, a fact which is explained by the laxative properties of the alkaline salts in beet molasses.

The toxicity and hygienic and therapeutic rôle of the mineral matter of molasses for horses, J. ALQUIER (*2. Cong. Internat. Aliment. Ration. Bétail, 1905, Raps., pp. 69–85*).—From the experimental evidence presented the conclusion was drawn that molasses is harmless and a hygienic nutritive material when the amount consumed per day does not exceed 3 or 4 kg. per horse.

Hunter-horse production in Ireland, W. J. KENNEDY (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 87, pp. 187–225, pls. 8*).— This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 691).

The poultry industry of Petaluma, California, P. H. LAWLER (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 92, pp. 316–322, pls. 8*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 692).

DAIRY FARMING—DAIRYING—AGROTECHNY.

The influence of changes in feeding upon milk production, J. L. HILLS (*Vermont Sta. Rpt. 1905, pp. 341–376*).—This is a compilation and discussion of the data obtained in the feeding trials reported in the tenth to the sixteenth annual reports of the station (1896–1903), inclusive, and relates to the effect upon production of changes in the total and digestible dry matter, digestible protein, digestible carbohydrates, and calories. Many deductions are made from the numerous tables which show in a condensed form, food consumption; production of milk, total solids, and fat with the food cost of each; and production proportioned to food consumption.

Among the author's generalizations are the following:

"(1) The testimony afforded by the results as between different rations and the same ration fed in different amounts is so nearly alike, speaking broadly, that one may safely group them together and argue on the basis of variations in dry matter or in nutrient consumption regardless of their origin.

"(2) When like quantities of the several nutrients were eaten, production was unaltered.

"(3) A 6 per cent increase or decrease in total dry matter eaten was accompanied by a corresponding 2 per cent change in yield; a 10 per cent increase or decrease, by a 5 per cent change in yield. . . .

"(4) A 7 per cent increase or decrease in digestible dry matter eaten was accompanied by a 3 per cent change in yield; a 12 per cent increase or decrease, by a 6 per cent change in yield; or, in other words, as food varied so did the yield, but to a less degree. . . .

"(5) As for digestible dry matter, so for digestible carbohydrates and for calories, word for word and, essentially, figure for figure.

"(6) A 3 per cent increase or decrease in digestible protein eaten had no effect on production; a 7 per cent increase or decrease was accompanied by a 2 to 3 per cent change in yield; and a 22 per cent increase or decrease by a 4 to 5 per cent change. . . .

"(7) A change in feeding of from more than to less than 15.5 lbs. of digestible nutrients or vice versa caused more decided changes in yield than did modifications in feeding on either side of that line, the average figures being 7 per cent and 4 per cent.

"(8) The nutritive ratio changes were evidenced in production fluctuations much as were those of digestible protein; when it narrowed, production generally increased, and vice versa.

"(9) The ultimate effect of a given food supply upon the milk flow is doubtless the more or less composite result of several coincidently active factors, including, primarily changes in the amounts of digestible nutrients taken as a whole; secondarily, changes in the amounts of digestible protein, and, probably, modifications in the proportions of digestible nutrients consumed in concentrates and in roughage.

"The writer's study of these data leads him to the conclusion that as a whole they do not support the doctrine which lays extreme stress on the paramountcy of protein; that they indicate that a ration with a nutritive ratio wider than 1:6, perhaps as wide as 1:7, or, indeed, in some cases one slightly wider, may prove economically as effective as the traditional 1:5.4; that a sufficiency of nutrients, affording enough available energy for bodily needs, if carrying a fair amount of digestible protein, not necessarily as much as 2.5 pounds, may prove economically as serviceable as does a richer ration."

Feeding trials with cows, J. L. Hills (*Vermont Sta. Rpt. 1905, pp. 377–404, 428–462*).—In the feeding experiments conducted during the year on the same general plan as in previous years (E. S. R., 17, p. 284) tests were made of India wheat meal, hominy feed, cotton-seed meal, and linseed meal, and further data were secured on the extent of experimental error in feeding trials. The experiments included 42 cows and covered a period of 25 weeks.

"*India wheat meal*, used in medium to small amounts, seemed a fair substitute, pound for pound, for wheat bran, and nearly so for a mixture of equal parts of cotton-seed and linseed meals, an outcome which its analysis would not have led one to expect and which has been confirmed by the concordant results of two seasons' trials.

"*Hominy feed* proved superior as a milk maker to a rather inferior grade of wheat bran, but did not appear to be the equal of cotton-seed and linseed meals, nor was it as economical a concentrate to use. This outcome has, likewise, the coincident testimony of two years' trials to back it.

"*Cotton-seed meal*, as compared with linseed meal, seemed to possess a small though measurable advantage as a milk and butter making by-product; and since it cost less and carried a greater plant-food content, it proved economically preferable."

When 6 to 8 animals are fed by the alternation system, it is believed that the experimental error may be held to be a negligible quantity.

A comparison of feeding trial methods, J. L. Hills (*Vermont Sta. Rpt. 1905, pp. 405–412*).—The results obtained during the year agreed with those previously reported, showing, in the opinion of the author, that the simple alternation system of conducting feeding trials is preferable to the combined method, but that the testimony of both is better than that of either alone.

Influence of sesame feeding on the yield of milk and the quality of milk, butter, and cheese, Moser, Peter, and Käppeli (*Jahresber. Molk. Schule Rütti-Zollikofen, 18 (1904–5), Beilage; abs. in Milchw. Zentbl., 2 (1906), No. 5, pp. 229–232*).—Sesame meal to the extent of 1 kg. per head daily produced a satisfactory increase in the yield of milk, but when increased to 1½ kg. was relatively less satisfactory.

The fat content of the milk showed no marked variations due to the feeding. The cheese was apparently unfavorably influenced by the larger quantities of sesame meal fed. The butter was regularly of good quality, although the opinions of the experts were not unanimous as regards the influence of this material on the quality of butter. In any case the influence on the butter was very small. With reference, therefore, to cheese making it is recommended that the quantity of sesame meal be limited to 1 kg. per head daily.

Influence on the fat content of milk of palm-nut cake as compared with rape-seed cake and peanut cake, T. von Szankowski (*Inaug. Diss., Univ. Halle, 1905; abs. in Milchw. Zentbl., 2 (1906), No. 5, p. 232*).—The author concludes that the palm-nut cake rich in fat exerts a favorable influence on the fat content of milk, the

cake poor in fat exerting more influence on the quantity of milk. The addition of oil acts unfavorably on both the yield and the fat content of the milk which, however, is not the case when the oil is present in the material in a natural state. Rape-seed cake in comparison with palm-nut cake increased the yield of milk but had no influence on the fat content. Peanut cake increased the yield of milk and fat only at the beginning of the feeding period.

Suggestions for construction of a modern dairy barn (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 90, pp. 6, figs. 2*).—It is the aim of this circular to present a plan for a dairy barn embodying the best ideas in scientific and sanitary construction consistent with practicability and cheapness.

Dairying at Park Royal, 1905, E. MATHEWS (*Jour. Roy. Agr. Soc. England, 66 (1905), pp. 93–111*).—Tests of the butter and milk production of a number of cows of different breeds exhibited at the show of the Royal Agricultural Society in 1905 and several butter-making experiments are reported. The experimental work was largely for the purpose of furnishing object lessons and consisted in making butter from milk obtained after short and long periods of secretion, comparing butter made from the milk of different breeds, churning at different temperatures, etc.

Record of the station herd for 1904–5, J. L. HILLS (*Vermont Sta. Rpt. 1905, pp. 422–427*).—Records of 52 cows for the year are reported. Some of the average results are as follows: Yield of milk 5,343 lbs., fat content 5.25 per cent, total solids 14.73 per cent, yield of butter 323.6 lbs., cost of food $58.31, and proceeds from sale of butter $96.93.

On the variations in the constituents of cows' milk during the course of lactation, F. PRACHFELD (*Inaug. Diss., Univ. Leipzig, 1905; abs. in Milchw. Zentbl., 2 (1906), No. 5, pp. 228, 229*).—The greatest variations in individual constituents occurred during the second and third months and at the close of the lactation period. Variations in fat, sugar, proteids, and ash decreased in the order mentioned. In general, the percentages of fat, proteids, and ash in the milk increased and the percentage of sugar decreased from the beginning to the second or third month of the lactation period, from which time on until the end of the period these relations were reversed.

Investigations on the relations of the properties of the blood (erythrocytes and hemoglobin) to the productive capacity of milch cows, E. SCHULTZ (*Fühling's Landw. Ztg., 55 (1906), No. 8, pp. 272–286*).—The investigations, which were made with 3 dairy herds, consisted in counting the red blood corpuscles and estimating the hemoglobin.

The red blood counts were found to be influenced by the age of the cows, stage of pregnancy, variations in altitude, and other causes. Averaging the data for the cows 4 to 6 years of age and of moderate productive capacity, a blood count of 6,320,000 erythrocytes per cubic millimeter was obtained for one herd, the production of which was 2,400 kg. of milk containing 3.76 per cent of fat; 6,640,000 for another herd producing 3,400 kg. of milk containing 3.08 per cent of fat; and 6,960,000 for a third herd producing 4,000 kg. of milk containing 4.01 per cent of fat, indicating a relation between the yield of milk and fat and the number of red blood cells.

The number of red blood cells showed a tendency to increase until the animals reached the age of 4 to 6 years, after which there was a decrease. There was also a decrease in the later stages of pregnancy. More dependence was placed upon the blood counts than upon the hemoglobin estimations, but in general the two determinations varied proportionately. With animals in advanced pregnancy and those kept at high altitudes the hemoglobin was relatively increased, while with young animals and those very productive the proportion of hemoglobin to red cells was reduced. A high content of hemoglobin and a high blood count are considered favorable to milk secretion, and it is suggested that these might be increased by breeding.

On the lecithin content of milk, W. KOCH (*Ztschr. Physiol. Chem., 47 (1906), No. 4-6, pp. 327-330*).—What has heretofore been reported as lecithin, the author considers a mixture of lecithin and cephalin. The two substances may be separated by precipitation of the cephalin from an alcoholic solution by means of an ammoniacal solution of lead acetate. Both lecithin and cephalin are considered present in milk in sufficient quantities for estimation. Failure to find lecithin in milk is believed to be due to the common error of treating lecithin as a fat and extracting with ether. Lecithin, however, does not behave the same as a fat and in separating milk it remains for the most part in the skim milk rather than being removed in the cream.

A comparison of the composition of the casein of human, cows', and goats' milk, E. ABDERHALDEN and A. SCHITTENHELM (*Ztschr. Physiol. Chem., 47 (1906), No. 4-6, pp. 458-465*).—From 200 gm. of water-free casein prepared from goats' milk, the authors obtained by hydrolysis, alanin 3 gm., leucin 14.8 gm., prolin 9.24 gm., phenylalanin 5.5 gm., glutaminic acid 22.5 gm., aspartic acid 2.2 gm., and tyrosin 9.9 gm. From 7 gm. of casein prepared from human milk 0.33 gm. of tyrosin and 0.28 gm. of glutaminic acid were obtained in the same manner. The albumin from human milk yielded 1.26 per cent of tyrosin and 0.98 per cent of glutaminic acid, the latter being considered much too low.

Preliminary communication on the glycocoll content of milk proteids, E. ABDERHALDEN and A. HUNTER (*Ztschr. Physiol. Chem., 47 (1906), No. 4-6, pp. 404-406*).—From a mixture of albumin and globulin prepared from cows' milk there were obtained by hydrolysis with hydrochloric acid, glycocoll, alanin, leucin, prolin, phenylalanin, glutaminic acid, and aspartic acid. Whether the glycocoll comes from the albumin or globulin or both is yet to be determined. The quantity is small, only 1.2 gm. of the ester being obtained from 100 gm. of the albumin or globulin.

A comparison of udder conformation and of milk production, J. L. HILLS (*Vermont Sta. Rpt. 1905, pp. 419-421*).—Five cows classed as having well-balanced udders produced on an average 5,725 lbs. of milk and 342 lbs. of butter yearly for an average of 3 years; 18 cows having fairly well-balanced udders, 5,377 lbs. of milk and 333 lbs. of butter yearly for 3.5 years; and 11 cows having poorly formed udders, 5,219 lbs. of milk and 324 lbs. of butter yearly for 3.6 years.

A comparison of the yield of the fore and hind quarters was made with 5 cows, the results showing a yield of 46 per cent for the fore quarters and 54 per cent for the hind quarters, the quality being practically identical. The results were the same whether the fore quarters or the hind quarters were milked first.

A trial of the Hegelund or Danish method of milking, J. L. HILLS (*Vermont Sta. Rpt. 1905, pp. 412-418*).—The Hegelund manipulation method was compared with extra-thorough stripping. The tests were made with 7 cows and covered 3 or 4 periods of 5 weeks' duration each.

When the Hegelund method was employed the first portion of the milking obtained in the ordinary manner was reduced in quantity and slightly in quality, but when taken with the residual milk obtained by manipulation the two portions together showed an increase in yield and a slight tendency toward better quality. With extra stripping the first portion showed likewise a reduction in quantity and quality, but when the strippings were added there was a gain in yield in but a single instance.

More food was consumed by the cows when the two special methods were employed, obviously introducing, according to the author, an element of doubt as to how much of the gain was due to manipulation and how much to increased food consumption.

The increased yield obtained by the Hegelund method was considered hardly more than sufficient to pay for the extra labor involved while the extra stripping was done at a loss.

"If, as is probably the fact, the persistency of the milking habit and the more per-

fect development of the udder are encouraged by either procedure, its adoption has considerable justification, particularly with heifers. This phase of the matter, however, is not included within the scope of the present inquiry. On the other hand, the additional load of dirt, dandruff, hair, dried manure, bacteria, etc., which fall into the milking pail because of the udder manipulation, is a distinct detriment, which, however, the use of some of the covered pails would go far to obviate."

The economic production and distribution of clean milk, J. Roby (*Jour. Amer. Med. Assoc., 46 (1906), No. 19, pp. 1430–1432*).—This discussion relates particularly to the milk supply of Rochester, New York.

Average monthly counts for 6 years showed the presence of about 100,000 bacteria per cubic centimeter in the milk supply of that city in winter and about 500,000 in summer. Notwithstanding the practical assurance of an increase of 3 cts. per quart in the price of milk, only one farmer was found who was willing to undertake the production of certified milk. In this instance the milk which was produced without expensive equipment showed on an average of 100 determinations the presence of only 3,853 bacteria per cubic centimeter.

In supplying milk to cities the author suggests the use of pails or cans holding about 15 qt. for milking, shipping, and, if desired, for delivering milk. After emptying, the cans are sent to a plant in the city where they are washed by machinery, covered with cheese cloth and a metal cover, and over both a stout canvas cover, and then sterilized by dry heat. The cans are then returned to the farm, where the canvas and metal covers are removed and the milk drawn directly through the cheese cloth into the can. The strainer is then removed and returned to the sterilizing plant with the canvas cover. The cans are at once covered and the milk is cooled by placing the cans immediately in ice water.

Investigations of the causes of the low Reichert-Meissl numbers of Holland butter, A. J. Swaving (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 9, pp. 505–520, dgms. 5*).—From September 15 to December 19, 5 groups of 4 cows each were fed different rations supplementing grass or hay and linseed cake and determinations were made of the Reichert-Meissl number of the butter made from the milk of each animal.

The content of volatile fatty acids was increased by fodder beets and by lucern silage. Grass silage exerted little or no influence as did also barley meal and sugar when fed as supplements to pasture and linseed cake. The Reichert-Meissl number was lowered by hay and linseed meal alone. While it is not yet clear in what manner the beets influence favorably the Reichert-Meissl number, the author considers that there is now better support for the previously expressed view that easily decomposed carbohydrates, such as sugar, favor the formation of volatile fatty acids only when fed along with materials already undergoing fermentation or easily fermented, such as fodder or sugar beets.

Bacteriological examinations of butter, A. Reitz (*Centbl. Bakt. [etc.], 2. Abt., 16 (1906), No. 7–9, pp. 193–212*).—This is a review of the literature on the occurrence of tubercle bacilli in butter, the bibliography given containing reference to the publications of 73 investigators. The author examined 100 samples of butter obtained in Stuttgart by means of inoculation experiments with animals. The results for 6 samples were inconclusive. In 8 or 8.5 per cent of the remaining samples, tubercle bacilli were found present.

Casein as an adulterant of butter, R. Racine (*Ztschr. Öffentl. Chem., 12 (1906), No 9, pp. 169, 170*).—A sample of adulterated butter showed the presence of 5.49 per cent of casein and 24.73 per cent of water.

The chemical composition of whey and curd during the manufacture of Emmenthal cheese, G. Koestler (*Milchw. Zentbl., 2 (1906), No. 5, pp. 193–224*).—According to the results of the author's investigations, the addition of rennet changes the chemical composition of the milk only to the extent of increasing the content of

soluble nitrogenous substances, the inclusion of which in the cheese may be regulated to a certain extent by manipulative methods.

At the time of cutting the curd, the whey shows, for the first few minutes, a decrease in the percentages of fat and proteids due probably to the effect of delayed coagulation, but later the fat content of the whey is increased. The acidity of the whey decreases during the process of manufacture due especially to the disappearance of carbon dioxid. The average of 38 determinations showed a decrease in acidity of 0.41 cc. of one-fourth normal potassium hydroxid per 100 cc. of whey. The total ash in whey decreases during the manufacturing process, the water soluble portion, however, showing an increase. The percentages of phosphoric acid and calcium are decreased.

The paracasein shows no changes in composition while in the kettle. The coagulating power of the whey due to the rennet remains constant until destroyed by the heating. A rapid increase in the acidity of the expressed whey is apparently due to an increase in the concentration of the whey and to lactic-acid fermentation.

Note on Dutch cheese, C. H. CRIBB (*Analyst, 31 (1906), No. 361, pp. 105-111*).—Analyses are reported of 25 samples of Edam, Gouda, and other types of cheese imported into England from Holland. Many of these samples showed less than 5 per cent of fat and were consequently considered as made wholly from skim milk. Failure to secure conviction in a trial for adulteration was due to the want of any standard for such cheese.

Carbonated milk, L. L. VAN SLYKE and A. W. BOSWORTH (*Abs. in Science, n. ser., 23 (1906), No. 592, p. 712*).—Fresh milk treated with carbon-dioxid gas under pressure of 60 to 70 lbs. kept from 10 days to 2 weeks at a temperature of 60 to 70° F. and made a very palatable, refreshing beverage. Further work is to be done along this line before the detailed results of the experiments are to be published.

Artificial milk, R. RACINE (*Ztschr. Öffentl. Chem., 12 (1906), No. 9, pp. 167, 168*).—An examination of a so-called artificial milk showed it to be a mixture of sirup and sesame oil emulsified with some proteid substance. This, diluted by the addition of 9 parts of water, is recommended for use in bakeries as a substitute for milk.

A new wine-cooling machine, F. T. BIOLETTI (*California Sta. Bul. 174, pp. 27, figs. 6*).—"The machine consists essentially of a copper tube 220 ft. long and 1¼ in. in diameter, through which the wine is pumped and which is inclosed in a canvas irrigating hose 4 in. in diameter, through which cold water runs in a direction opposite to that of the wine."

Preliminary tests with small models of this cooler are reported, as are also comparative tests of other cooling machines. It is thought possible that iron may be substituted for copper pipes, although this is not at present recommended, as tests have not been made on a practical scale. The leakage through the canvas hose permits the utilization of the cooling due to evaporation, which, under average working conditions in a dry climate, is estimated as equivalent to the use of water about 3° F. cooler in a machine where this evaporation could not take place.

Tests were made with water and must at different temperatures and with different ratios in the volumes of water and wine. One test of the new machine showed that 1,000 gal. of fermenting wine can be lowered from 95 to 78° in 1 hour by the use of 850 gal. of water at 71.5° Specifications are given for the construction of a cooler of this type suitable for the use of a cellar making not more than 300,000 gal. of dry wine during a vintage of 30 days with directions for using the cooler in order to secure the greatest efficiency, the latter including formulas and tables for calculating the number of degrees the must or fermenting wine must be cooled and the number of hours the cooler must be used.

The manufacture of Samshu (Chinese spirit) from Sorghum vulgare, E. H. WILSON (*Gard. Chron., 3. ser., 39 (1906), No. 1005, pp. 194, 195*).—This is a brief account of the methods employed in North China and Manchuria in the manufacture of this distilled liquor from sorghum seed.

VETERINARY MEDICINE.

Handbook of pathogenic micro-organisms, W. Kolle and A. Wassermann (*Handbuch der pathogenen Mikroorganismen. Jena: Gustav Fischer, 1906, Sup., pt. 1, pp. 384, pls. 7, figs. 27*).—This is the first supplemental volume to the large work published under the supervision of the editors and contains an account of trypanosomes, pyroplasmosis, tuberculosis of animals and man, bacterial hematoxins, amebic dysentery, leprosy, and typhoid fever. The latest literature relating to these topics is discussed in connection with bibliographies.

It appears from the review of the literature on tuberculosis that mammalian tubercle bacilli must be divided into 2 types, the human and bovine. It is possible to choose a dose so small that when bovine tubercle bacilli are used in inoculating experimental animals generalized tuberculosis results, while with a dose of the same size of human tubercle bacilli no infection takes place.

A treatise on the parasites and parasitic diseases of the domesticated animals, L. G. Neumann, trans. by G. Fleming (*London: Baillière, Tindall & Cox, 1905, 2. ed., pp. XVI + 697, figs. 365*).—The present edition has been revised and edited by J. MacQueen and contains as heretofore, but in a revised form, a detailed account of the parasites affecting domestic animals. These parasites are arranged according to the organs or parts affected as, for example, the skin, digestive apparatus, serous membranes, respiratory apparatus, circulatory apparatus, muscles, connective tissue, bones, nervous system, and genito-urinary organs. An elaborate bibliography of literature relating to this subject is appended to the volume (pp. 647–678).

Police sanitation of animals, A. Conte (*Police sanitaire des animaux. Paris: J. B. Baillière & Sons, 1906, 2. ed., pp. XII + 532*).—The government veterinary sanitation in France and her colonies is presented in great detail for the guidance of veterinarians who are concerned with this work.

In a preface to the volume E. Leclainche makes a number of suggestions regarding possible lines of improvement in existing laws. The volume as a whole is divided into three parts relating to veterinary sanitation of France, the colonies, and special information regarding the duties and functions of officials connected with the work.

An elaborate review of the development of the French veterinary laws is presented, together with a discussion of all general sanitary measures relating to the visitation of infected premises, declaration of infection, disinfection, indemnities, supervision of diseased animals, and the general practices of police sanitation.

Special chapters are also given on legislation relating to rabies, cattle plague, contagious pleuro-pneumonia, blackleg, tuberculosis, sheep pox, foot-and-mouth disease, glanders, dourine, swine erysipelas, hog cholera, etc.

Therapeutic technique, W. Schlampp (*Therapeutische Technik. Stuttgart: F. Enke, 1906, vol. 1, pp. VII+419, figs. 171*).—In this part of the author's work on the technique of general therapy for veterinarians attention is given to a discussion of therapeutic measures applicable to the skin. The material which naturally falls under this head is classified according to the nature of the remedies used.

Special chapters are devoted to application to the skin of various fluids, salves, pastes, soaps, varnishes, plasters, powders, and paints. The methods of removing the hair are also discussed and an account is presented of treatment of the skin by means of surgical operations, subcutaneous inoculation, irritation of the skin, the use of blisters, and methods adopted for the protection of animals against various parasitic skin infections. The nature and use of a large number of drugs are carefully considered.

Experimental studies on the permeability of the walls of the alimentary tract of newborn animals for bacteria and proteids, A. Uffenheimer (*Arch. Hyg., 55 (1906), No. 1–2, pp. 1–139, pl. 1*).—The author conducted a long series of

experiments in feeding new-born animals with virulent cultures of anthrax and tuberculosis, as well as with certain proteids.

In all cases great care was exercised not to injure the mucous membrane in any way so that the infection which followed could be attributed to the permeability of the intestinal walls for the bacteria in question. The experimental animals were guinea pigs and rabbits. By means of tubes and pipettes it was found possible to measure in a very accurate manner the amounts of bacterial cultures fed to the animals. During these experiments it was found that the anthrax bacillus leaves the alimentary tract very readily.

Within 6 hours after feeding the feces contained anthrax bacilli in large numbers, while after 17½ hours they were to be found only in isolated cases. The anthrax bacillus, however, did not lose its virulence in passing through the alimentary tract. It was found that young guinea pigs could be fed very large quantities of virulent anthrax bacilli without causing any infection. Even spore-bearing cultures failed to be pathogenic. When these experiments were carried out according to the requirements of von Behring the guinea pigs remained in perfect health.

In experiments with tubercle bacilli the results were quite different. Within a few days after feeding large quantities of tubercle bacilli, some bacilli were found in the glands of the omentum and liver. When only small quantities were fed, however, the tubercle bacilli could not be found in the glands. Apparently the bacilli passed through the walls of the alimentary tract very rapidly. In certain stages of the process, especially in the cecum and vermiform appendix, sections were made of this material and examined microscopically. Notes are also given on the permeability of the intestines for hemolytic serum, casein, albumen from hens' eggs, and various antitoxins.

Bacillus necrophorus and its economic importance, J. R. Mohler and G. B. Morse (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 91, pp. 76-116*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 702).

Report of the chief inspector of stock, R. E. Weir (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 6, pp. 527-531*).—An account is given of the present government veterinary staff of Western Australia. Brief mention is also made of the prevalence of pleuro-pneumonia, tuberculosis, hog cholera, and Texas fever among animals as well as poisonous plants. The author discusses the present status of horse, cattle, and sheep raising and gives brief notes on the condition of pastures, abattoirs, and the registration of brands.

Books, memoirs, and articles on tuberculosis, Bouchez (*Rev. Tuberculose, 2. ser., 3 (1906), No. 1, pp. 98-120*).—A classified bibliography is presented of literature relating to tuberculosis in man and animals. The books and articles referred to are grouped under natural classes according to the organs affected by tuberculosis and into general groups—hygiene, pathology, therapeutics, experimental veterinary medicine, etc.

Cattle tuberculosis, H. Sessions (*New York: W. R. Jenkins, 1906, 2. ed., pp. VII+120*).—This edition has been practically rewritten and brought up to date by the addition of much new material, particularly with reference to the recent discoveries relating to tuberculosis in cattle. The subject-matter in the volume includes an introduction and chapters on human tuberculosis as related to bovine tuberculosis, cause of the disease, symptoms and diagnosis, tuberculin test, milk inspection, meat inspection, disposal of tuberculous carcasses, and insurance of cattle intended for slaughter.

Danger of infection with tuberculosis by different kinds of exposure, E. C. Schroeder and W. E. Cotton (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 83, pp. 44-65*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 699).

Danger from ingestion of tubercle bacilli killed by heat, A. CALMETTE and M. BRETON (*Presse Méd.* [*Paris*], *1906, No. 15, p. 115*).—Young guinea pigs were fed a single dose of 1 to 2 cg. of tubercle bacilli of bovine origin freshly dried and mixed with potato or carrots.

In all cases the guinea pigs died of generalized tuberculosis after about 92 days. Further experiments were then made with bacilli which had been heated to a temperature of 100° C. for a period of 5 minutes. In guinea pigs which were fed such material in doses of 1 to 2 cg. infection took place promptly and death occurred within 37 to 48 days. Hypertrophy of the renal capsules was observed and other lesions resembling those which occur in animals inoculated with repeated large doses of tuberculin. It appears, therefore, that tubercle bacilli killed by heat are not inert bodies for susceptible animals.

The infectiousness of milk and meat from tuberculous animals, H. PERICAUD (*Prog. Vét., n. ser., 26* (*1906*), *No. 4, pp. 135–137*).—Attention is called to the fact that while bovine bacilli are doubtless very virulent for man they are seldom found in the meat of tuberculous animals. As a rule, therefore, such meat can be used without harm. Milk from tuberculous cows, however, must be considered as dangerous and should be sterilized in some manner before being used.

The frequency of tuberculosis in the dairies of Paris, H. MARTEL (*Rev. Soc. Sci. Hyg. Aliment., 2* (*1905*), *No. 6, pp. 559–563*).—Attention has already been called by the health authorities of Paris to the prevalence of tuberculosis among herds which furnish milk for the city. A tuberculin test carried out on 628 cows gave a reaction in 215, or 34.2 per cent, of the animals. On account of this large percentage it is urged that the measures prescribed by the health authorities of Paris be carried out strictly and that further precautions be taken to avoid the subsequent contamination of stables by the introduction of tuberculous animals or otherwise.

The lymphocyte and tubercle bacillus, J. BARTEL and W. NEUMANN (*Centbl. Bakt.* [*etc.*], *1. Abt., Orig., 40* (*1906*), *No. 4, pp. 518–537*).—It has usually been assumed that the lymphatic organs and glands must exercise more or less influence upon tubercle bacillus for the reason that this bacillus is carried to so large an extent throughout the organism in the lymphatic system and affects in so large a per cent of cases the lymphatic glands.

Notwithstanding the apparent logical basis for such an assumption the demonstration of any direct influence of the leucocytes upon the tubercle bacillus has proved a difficult matter and in the case of most investigations only negative results have been obtained. In the author's experiments this matter was tested in vitro by placing material from the lymphatic glands in cultures of tubercle bacilli. Such material after varying lengths of time was used for further inoculation of experimental animals.

When the substance of mesenteric glands was used in such tests it was found that animals inoculated with the mixture did not become infected with tuberculosis and showed no infiltration at the point of inoculation or changes in the corresponding lymphatic glands. The substance of the spleen and the lymphatic glands appears, therefore, to exercise an important influence in combining the toxins of tubercle bacillus in essentially the same manner described by Brieger, Kitasato, and others. Tubercle bacilli kept in contact with such material for 22 days were not capable of producing any reaction at the point of inoculation.

Tuberculosis of the spleen in guinea pigs, C. ACHARD and P. EMILE-WEIL (*Arch. Méd. Expt. et Anat. Path.* [*Paris*], *18* (*1906*), *No. 1, pp. 71–84*).—A number of types of splenic lesions were observed in tuberculosis in the guinea pig. The ordinary splenic tuberculosis shows small granulations in the slightly congested parenchyma. In another type the tubercles fuse, causing a filtration of the organ. Hemorrhagic tuberculosis is also observed in some cases. In this type of the disease the spleen is much enlarged, weighing from 5 to 35 gm.

Experience with von Behring's method of protective vaccination of cattle against tuberculosis, SCHRICKER (*Wchnschr. Tierheilk. u. Viehzucht, 50 (1906), No. 7, pp. 121-128*).—Von Behring's method of vaccination against tuberculosis has been in practical use for 3 years and the results obtained, therefore, give a good foundation for judging its effectiveness.

The author vaccinated 76 animals by this method without any bad effects, and on evidence of live tubercle bacilli were found in any of the animals which were subsequently killed and examined. It is concluded, therefore, that a protective vaccination of calves under 4 months of age is capable of greatly increasing the resisting power toward tuberculosis and in some cases checks slightly the development of an infection already existing at the time of vaccination.

The prevention of tuberculosis in cattle, J. WILSON (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 2, pp. 300-304*).—Tuberculosis in cattle according to the author is chiefly spread by means of the air and food. Notes are given on these different methods of infection and on the prevalence of tuberculosis in England. It is estimated that from 5 to 10 per cent of the yearlings in England are infected, 10 to 20 per cent of 2-year olds, and 40 to 60 per cent of adult cows. Attention is called to the danger from mammary tuberculosis in cows and to the use of tuberculin and other methods in the detection and eradication of the disease.

Anthrax, D. LAN (*Rev. Facult. Nac. Agron. y Vet., 2. ser., 1 (1905), No. 6, pp. 173-176*).—Veterinarians in various parts of South America are frequently called upon to deal with outbreaks of anthrax. The author presents a brief account of the course of the disease and of the usual methods of vaccination to immunize animals against it.

Immunization of the guinea pig and rabbit against anthrax, F. MARINO (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 6, pp. 306-308*).—In the author's experiments it was found possible to vaccinate guinea pigs against anthrax by means of subcutaneous injections of the first vaccine. It was very difficult to produce immunity, however, by intraperitoneal injections.

Guinea pigs which withstood repeated subcutaneous injections of a mixture of anthrax and preventive serum from a rabbit or guinea pig frequently failed to resist the minimum mortal dose of the first vaccine. The normal serum of rabbits mixed with virulent anthrax and injected hypodermically into guinea pigs protects them against the disease.

The pathological anatomy of glanders, SCHÜTZ (*Ztschr. Veterinärk., 18 (1906), No. 2, pp. 49-62*).—This statement was originally prepared in 1882, for the guidance of army veterinarians in determining cases of glanders and for use in diagnosing the disease from pathological material sent to the veterinary school in Berlin. The article in its present form has been recently revised and brought up to date.

Observations on normal and rinderpest blood, F. S. H. BALDREY (*Jour. Trop. Vet. Sci., 1 (1906), No. 1, pp. 47-69*).—In a study of the normal blood it is found that the average number of red blood corpuscles was 7,298,484 per cu. mm. The number varied, however, from 5,600,000 to 9,100,000 and the number of leucocytes varied from 8,000 to 18,000.

In arriving at these averages a large number of counts were made. An examination was also made of the blood of animals which had been bled for the production of a protective rinderpest serum. In these animals it was found that the average number of red blood corpuscles was 3,713,000 per cu. mm. In animals actually suffering from rinderpest the number of leucocytes increases rapidly, rising to 32,000 by the fourth day. The relative proportion of the various elements in the blood is discussed for other diseases as compared with rinderpest.

Redwater in cattle, A. E. METTAM (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 2, pp. 248-260, pls. 3*).—This disease, under various names, occurs in North and South America, Africa, Australia, various parts of Asia, and Europe. The

blood parasite which causes the disease is described and notes are given on the symptoms of redwater or Texas fever. A summary account is also given of some of the experimental work done in this country on this disease.

Cattle tick investigation, A. MAYER (*Proc. La. Agr. Soc. and Stockbreed. Assoc., 1905, pp. 103-110*).—Attention is called to the great economic importance of the cattle tick.

This pest not only stunts the development of cattle so that they fail to reach their normal size, but also reduces the market price of cattle raised below the quarantine line. On account of the fact that there are large tick-free areas below the quarantine line cattle raised on such areas must be inoculated or gradually infested with ticks in early life, otherwise they are as susceptible to Texas fever as northern cattle. Considerable reliance is placed in the use of good dips for destroying ticks, but attention is called to the desirability of systematic work in exterminating the tick.

The etiology of pneumonia, RIES (*Berlin. Tierärztl. Wchnschr., 1906, No. 8, pp. 129, 130*).—Excellent opportunity was had for the study of this disease in horses. It appeared as an infectious disease without special localization in the lungs, and at the outbreak of the symptoms considerable catarrh was noted in the upper part of the respiratory passages, but this was much less pronounced than the catarrhal condition of the duodenum. The temperature rose on the second day to 40.5° C., but fell to normal again within 8 days.

The persistence of tetanus spores in the animal organism in a latent form, G. TAROZZI (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1906), Nos. 3, pp. 305-311; 4, pp. 451-458*).—Guinea pigs and rabbits were used in the experiments reported in this paper, being inoculated with virulent tetanus cultures which had been kept under aerobic conditions. Only 11 animals were used in the experiments for the purpose of determining whether and how long tetanus spores remain in a latent condition in inoculated animals.

It was found possible to demonstrate the spores in all cases in the liver, usually in the spleen, but, as a rule, not in the kidneys. The author considers that these experiments demonstrate that the tetanus spores pass into the general blood circulation from the point of inoculation and become located in various vital organs where they may persist in a virulent condition for a long period. When removed from such organs they are capable of producing very toxic cultures.

Infectious diarrhea of calves and liver disease of chickens, N. S. MAYO (*Estac. Cent. Agron. Cuba Circ. 22, pp. 4*).—Brief notes are given on the distribution of infectious diarrhea in calves together with notes on the rate of mortality and antiseptic treatment to be adopted in preventing the disease. For this purpose the author recommends creolin. A disease of fowls known as little liver is described. The disease is, however, not characterized by lesions in the liver, but by symptoms which closely resemble those of roup. In treating the disease the author recommends the use of potassium permanganate in water at the rate of 1 part to 60.

Diseases of the stomachs in ruminants, J. L. WEBB (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 1, pp. 1-7*).—Cattle are susceptible to various digestive troubles on account of their tendency to eat various indigestible or otherwise harmful substances. In this way hair balls are formed in the stomach and actual lesions may be produced as the result of eating bones or other materials with sharp points. An account is given of impaction of the omasum, gastritis, and parasitic irritation of the fourth stomach. In removing these parasitic worms the author recommends the use of a mixture of 2 oz. areca nut and 30 grains of arsenic made into 10 doses and given daily for a period of 6 days in bran.

Enzyms in cornstalks and their relation to cornstalk disease, T. M. PRICE (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 84, pp. 66-75*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 702).

Observations on Bilharziosis among animals in India, R. E. MONTGOMERY (*Jour. Trop. Vet. Sci., 1 (1906), No. 1, pp. 15–46, pls. 2*).—The characters of the genus Bilharzia or Schistosomum are mentioned in some detail. The form which occurs commonly in cattle is *Schistosomum bovis*.

Particular attention is given in this article to bilharziosis in the horse. The author had opportunity to make a number of post-mortem examinations on affected horses in the plains and hill regions. In addition to the blood parasite which is described as new under the name *S. indicum*, various tapeworms, flukes, and roundworms were found as well as bots. Many of the cases under observation were complicated with surra. The abdominal cavity was found to be in a state of general congestion, as well as the liver and pancreas. The intestinal tract is also the seat of various pathological lesions. The blood parasite may best be obtained from the portal vein of the liver.

A brief bibliography relating to blood parasites in the horse and ass is appended to the article.

Prevention of sheep pox, D. D. GARCIA (*Gac. Med. Zool., 30 (1906), No. 4, pp. 51–54*).—On account of the wide distribution of this disease the importance of practical methods for its control is quite evident. The author calls attention to the use of a preventive and curative serum against sheep pox.

Dipping as a means of preventing ovine diseases, F. A. VERNEY (*Natal Agr. Jour. and Min. Rec., 9 (1906), No. 1, pp. 11, 12*).—Since *Amblyomma hebræum* is the species of tick which is concerned in carrying heartwater, it is recommended that sheep be dipped for the destruction of this tick in order to control the disease.

Sheep botfly, E. THIERRY (*Jour. Agr. Prat., n. ser., 10 (1905), No. 37, pp. 344, 345, fig. 1*).—The appearance and distribution of this insect are briefly outlined. No curative nor preventive remedies are known which are practical and effective. The palliative measures usually recommended are briefly discussed.

Some common parasites of sheep (*Dept. Agr. and Tech. Instr. Ireland Jour., 6 (1906), No. 2, pp. 295–299, pls. 2*).—A discussion is presented of scab mite, sheep ticks, nostril fly, sheep maggots, and biting lice, remedies being recommended for the control of each one of these troubles.

The life history of the twisted wireworms (Hæmonchus contortus) of sheep and other ruminants, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 93, pp. 7, figs. 2*).—The common stomach worm of sheep is described in its various stages and particular attention is given to a summary of its life history.

It appears that the sheathed embryos of this parasite on grass in infested pastures are capable of great resistance toward cold and desiccation. It is evident, therefore, that the parasite is not destroyed in pastures by the cold weather of winter. The life history of this worm is comparatively simple. The eggs in the feces of infested animals hatch and the young crawl up the stems of grass where they become covered with the sheath and are later taken into the stomach of sheep in grazing. Feeding experiments were carried out which showed that the worm is in a condition to develop in the stomach of sheep when eaten along with grass.

The best method of cleaning up infested pastures consists in burning the grass. It is quite uncertain how long a time must be allowed for the starvation of the embryos and vermifuges can not be depended upon to expel the worms entirely from infested sheep. Experiments are in progress to test the method of raising lambs free from infection.

Swine plague, SCHMIDT (*Berlin. Tierärztl. Wchnschr., 1905, No. 51, pp. 865–869*).—This is a controversial article in which attention is called to the more or less incompatible claims made by various investigators and to the recent discoveries made by the Bureau of Animal Industry in regard to a form of hog cholera caused by a filterable virus. An editorial note is appended to the article in which it is stated that

the subject of swine diseases was not discussed so thoroughly at the recent international veterinary congress as the diseases of other animals.

The immunization against swine plague by means of bacterial extracts, J. CITRON (*Ztschr. Hyg. u. Infectionskrank., 52 (1906), No. 2, pp. 238–262*).—During a long series of experiments it was clearly shown that it is possible by means of a serum obtained from actively immunized rabbits to protect other rabbits, guinea pigs, and white mice against doses of bacteria many times the fatal size. The serum of normal rabbits in smaller quantities did not increase the resisting power of animals into which it was inoculated. The author believes, therefore, that the existence of specific complements in the blood is shown beyond question.

Through what agency is the Trypanosoma evansi carried over from one surra season to another? A. LINGARD (*Jour. Trop. Vet. Sci., 1 (1906), No. 1, pp. 92–112*).—Surra is usually fatal in horses, asses, mules, camels, goats, sheep, rats, dogs, and buffaloes. In cattle, however, both in the plains and hill breed, the disease when uncomplicated frequently terminates in recovery.

Cattle may carry the blood parasite for long periods, at least exceeding a year, and are, therefore, the only domestic animals found by the author to be capable of resisting spontaneous inoculation with trypanosomiasis. It is important, therefore, to determine whether cattle affected with this chronic form of the disease are agents in its transmission. As a result of the author's investigations it was found that the blood of cattle affected with the chronic form of the disease, when inoculated into susceptible horses, causes fatal cases of trypanosomiasis, and from such cases the rapid dissemination of the disease may occur.

Camels may also carry the disease for from 9 to 12 months and their blood is likewise pathogenic for horses. It is also found that dogs and cats are susceptible to the disease carried by camels. It is probable, although not definitely demonstrated, that various other wild carnivorous animals may be the agents in carrying the disease. The most rational system of controlling the disease, in the author's opinion, consists in the destruction of all affected horses in which the disease occurs in a virulent form.

Tibarsa surra, H. T. PEASE (*Jour. Trop. Vet. Sci., 1 (1906), No. 1, pp. 70–91*).—Camels have long been known to be susceptible to surra and considerable attention has been given to a study of this disease, with particular reference to its relation to other similar blood diseases. As a result of the author's investigations it is concluded that the form of surra which occurs in camels is due to *Trypanosoma evansi*, the same species which occurs in horses. The disease is often found affecting camels, horses, and mules in the same locality and is apparently due to the same cause.

A specific serum for Trypanosoma brucei and its effect upon T. gambiense, F. K. KLEINE and B. MÖLLERS (*Ztschr. Hyg. u. Infectionskrank., 52 (1906), No. 2, pp. 229–237*).—A serum was obtained from asses infected with *T. brucei*, which protected mice against fatal doses of this organism. It was observed, however, that the serum did not protect the animal from which it was obtained. Actively immunized trypanosomes inoculated into normal animals soon lost their immunizing property, so that a specific serum was found to be more active in the case of such animals. The serum showed considerable difference in its effect upon *T. brucei* and *T. gambiense*.

The action of brilliant green on the trypanosomes of nagana, H. WENDELSTADT and T. FELLMER (*Ztschr. Hyg. u. Infectionskrank., 52 (1906), No. 2, pp. 263–281, pl. 1*).—Brilliant green was administered subcutaneously in doses of 1 cc. in solution in the proportion of 1:200.

It was found that when experimental animals were thus treated the trypanosomes in the blood were soon affected to such an extent that they would not cause infection when inoculated into another animal. In the course of time brilliant green causes the entire disappearance of trypanosomes in the blood of rats, monkeys, and other experimental animals. The addition of small quantities of arsenic increases

this action. In the process of disintegration of trypanosomes in the blood under the influence of brilliant green a number of peculiar developmental forms were observed.

Piroplasmoses, L. PANISSET (*Rev. Gén. Méd. Vét., 7 (1906), No. 75, pp. 113–127, fig. 1*).—The distribution of these diseases throughout the world is briefly outlined, and descriptive notes are given on piroplasmoses in sheep, horses, and dogs, with an account of the symptoms and lesions in each case, etiology of the various forms of the disease, the agency of ticks in transmitting the disease, and immunization by means of vaccine and serum.

Piroplasmosis complicated with horse sickness, THEILER (*Rev. Gén. Méd. Vét., 7 (1906), No. 76, pp. 178–181*).—Brief notes are given on the occurrence of piroplasmosis among horses after inoculation with the virus of horse sickness. The development of piroplasmosis was due to the use of infected blood.

The treatment of nail pricks of the horse's foot, E. L. MOORE (*South Dakota Sta. Bul. 95, pp. 17–22*).—Attention is called to the fact that even slight injuries to the foot may develop serious complications on account of the fact that the foot is constantly in contact with the dirt which may carry bacteria.

In treating cases of nail pricks, followed by the formation of pus, the author obtained excellent results by cleansing the hoof with soap and water, paring away the horn of the hoof from around the affected part, then washing the part in a solution of corrosive sublimate, after which a piece of absorbent cotton is placed on the hoof and the whole firmly bandaged and covered with a thick coating of tar. A little cotton is allowed to extend above the tar bandage, and the corrosive sublimate solution may be applied daily without removing the bandage. This bandage should be left in place for from 7 to 10 days without being disturbed. Detailed clinical notes are given on a number of cases.

Poisoning of horses by Ornithogalum thyrsoides, D. HUTCHEON (*Agr. Jour. Cape Good Hope, 28 (1906), No. 2, pp. 165–172, pl. 1*).—A report was previously made on the death of horses from eating this plant and experiments were made in feeding dried plants which proved to be exceedingly poisonous. Further experiments were carried out in feeding the fresh green plant, and these experiments furnished the basis for the present article. It was found that two pounds of the fresh plant were sufficient to cause death in ponies within 2 days. The symptoms of poisoning are briefly discussed and notes are given on the distribution of the plant.

Examination of the Western Australian poison plants, E. A. MANN (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 6, pp. 550–561, pls. 5*).—Chemical analyses were made of various poisonous plants, including *Gastrolobium calycinum* and other species of this genus, as well as species of Oxylobium, particular attention being given to the first-named species. An alkaloid known as cygnin was isolated and was used in physiological tests with guinea pigs. It was found that this alkaloid was fatal for ordinary guinea pigs in hypodermic doses of $\frac{1}{10}$ to $\frac{1}{20}$ of a grain.

The rabies corpuscles of Negri, J. SCHIFFMANN (*Ztschr. Hyg. u. Infectionskrank., 52 (1906), No. 2, pp. 199–228*).—As the result of an extensive study of these bodies the author found that at times they may not be present in the medulla or spinal cord. They are subject to considerable variation with regard to their structure, distribution, and occurrence in the hippocampus and cerebellum, but this variation is independent of the incubation period and number of inoculations which have been made with the virus. After repeated passages of the virus Negri's corpuscles may be entirely absent in the hippocampus and cerebellum.

The tapeworms of American chickens and turkeys, B. H. RANSOM (*U. S. Dept. Agr., Bur. Anim. Indus. Circ. 85, pp. 268–285, figs. 31*).—This is reprinted from the annual report of the Bureau for 1904 (E. S. R., 17, p. 704).

RURAL ENGINEERING.

Irrigation investigations (*Kansas Sta. Rpt. 1905, pp. 26-41*).—This gives the results of investigations of irrigation at Fort Hays and Garden City, Kansas, carried on in cooperation between the Kansas Station and this Office. An account of this work was also given in Bulletin 158 of this Office (E. S. R., 17, p. 705).

Report of the reconnaissance of the Vaal River, F. A. HURLEY (*Pretoria: Transvaal Irrig. and Water Supply Dept., 1905, pp. XV+76, pls. 26*).—This report contains "preliminary descriptions and approximate estimates of the most favorable irrigation schemes practicable" from Vaal River in South Africa, a stream with an annual discharge of about 2,500,000 acre-ft., of which about 65 per cent passes during March floods.

Six projects are included, the two most urgently recommended irrigating 11,800 acres in the Transvaal and 27,800 acres in Orange River Colony. The third and fourth projects would irrigate 60,000 and 20,000 acres, respectively, while the fifth, which would involve an expenditure of about $25,000,000, would irrigate 400,000 acres, an undertaking not to be considered at present. The sixth project involves only Cape Colony land and is an expensive storage project not fully worked out as yet. The estimated costs per acre runs as follows: $77, $63, $76, $96, $50-60, and $112.

The annual water rate assumed is $5 to $7.50 per acre, and the increment in value of land $50 to $75 per acre. Maintenance charges are assumed to be about one-fifth of the water rentals, and the net return on the entire investment is estimated as about 6 per cent, except in the sixth project, where it is but 3.3 per cent. If the total increase in value of the land is deducted from the cost of the projects the estimated earnings run 126, 24, 14, 31, and 6 per cent, the fifth project not being included.

The duty of water is estimated on the basis of the severest possible system of cropping with a 3-year rotation of wheat, tobacco, vetches and rye, potatoes, beets and roots, vetches and rye, tobacco, and potatoes. It is further supposed that each irrigation will be 4 in. in depth and that in all 17 irrigations will be required in 3 years, the time of sowing and rainfall being considered. Allowing for 60 per cent loss, 1,000,000 cu. ft. of water must be stored annually for each 5 acres, or about 150 acres per cubic foot per second for a 9-months' season, allowing 20 per cent for roads and waste land. In order to meet the possible requirement of a 4-in. irrigation of the whole area in one month, the estimates for canals are on the basis of 100 acres per cubic foot per second. These estimates are reasonable when compared with the usual duty of 100 acres per cubic foot per second in Egypt, 100 to 300 in India, 120 and 150 under two California canals, and 150 in Spain and Italy.

In reviewing the subject of water rates the author cites as examples tracts in Cape Colony where land and water rent for $20 to $22 per acre, while in India the rate is about one-tenth and in Egypt one-seventh of the gross value of crops produced. Regarding the Reclamation-Act projects in the United States he says: "It would seem that the rates have been pitched very low to attract settlers." The rate assumed on the Vaal of $5 per acre is believed to be less than one-tenth the value of a crop of wheat and corn, the least valuable crops likely to be grown. The total cost to the renter, assuming 6 per cent interest on the value of the land, is considered reasonable, since it falls under $12.50 per acre annually.

A note by the director of irrigation, W. L. Strange, is included, in which it is stated that $15,000,000 in produce was imported into the Transvaal in 1904, showing a good market for irrigated products. He points out that the financial failure of irrigation works has usually been due to slow settlement, and that hence large works should be built by the State, which can afford to wait for returns in the form of general prosperity, and that the development of irrigation works should not outrun the normal settlement of the country.

Agriculture in the valley of the Ahr, H. DUPAYS and L. LEBRUN (*Jour. Agr. Prat., n. ser., 11 (1906), No. 8, pp. 241-248, figs. 5*).—This article describes briefly irrigation practice in the valley of the Ahr. The irrigation works are simple. The ditches are usually made with rectangular cross section in order that they may take up no more room than is necessary. Water is carried in rectangular flumes made of galvanized iron supported on I-beams. The water is used on meadows, the charges for water being 20 marks per hectare per year.

Pumping machinery at Mildura (*Impl. and Mach. Rev., 31 (1906), No. 372, p. 1406*).—At Mildura, Victoria, water is pumped for 8,000 acres of land. The water is raised at three separate lifts, 20, 25, and 25 ft. Water is pumped at the rate of 26,000 gal. per minute. As a rule there are five irrigations during the year, each lasting 28 days, and the pumps are run at a cost of $300 per day, or about $42,000 per year. The fuel is wood. The costs are met by a water tax which varies from 30 to 40 shillings per acre for the land covered. The land receives an average depth of about 22 in. per annum.

A Hawaiian pumping plant for irrigation (*Engin. Rec., 53 (1906), No. 10, p. 350*).—A description of a plant utilizing a small mountain stream by means of impulse wheels and an electric power plant. A method for regulating the speed of the dynamo, motor, and pump has been adopted so that the efficiency is not impaired when the supply in the hills is short. Larger impulse wheels are then used, giving a slower speed to the generator. With an automatic device to keep the field constant the voltage and cycles are diminished in proportion, the motor then falling off in speed without decreased efficiency.

Canals and ditches, M. RINGELMANN (*Jour. Agr. Prat., n. ser., 11 (1906), No. 7, pp. 210-212, figs. 8*).—This article summarizes foreign and American measurements of percolation of water from ditches, and discusses methods of prevention of losses in canals used for carrying water. It describes methods of preventing seepage losses, including concrete lining, masonry lining of ditches with rectangular cross sections, and the use of flumes.

The Belle Fourche dam, Belle Fourche project, South Dakota, R. F. WALTER (*Engin. Rec., 53 (1906), No. 9, pp. 307-310, figs. 7*).—This dam is one of the largest earth dams in the United States, being over a mile in length and containing 1,600,000 cu. yds. The details of the wasteway, conduits, and gates are described in detail. An unusual feature is the proposed concrete-block facing laid over gravel in lieu of riprap.

The Belle Fourche irrigation works, South Dakota, W. W. PATCH (*Engin. News, 55 (1906), No. 8, pp. 210-212, figs. 5*).—A brief account of the project, with a description of the more important structures used.

The drainage of earth roads (*Engin. Rec., 53 (1906), No. 18, pp. 564-566*).—This is an abstract of a bulletin on this subject by Prof. Ira O. Baker, published by the University of Illinois.

It is recommended that tile drains be laid at the side of the road at a depth of 3 or 4 ft., such a drain on one side of an ordinary country road being held to be sufficient. The drain might be more effective in the middle of the road, but the expense of putting it in would be so much greater that a drain at the side of the road is preferred. There is no limit to the steepness of the grades on which tile drains may be used, but the grade should not be less than 2 in. per 100 ft. It is important that the tile drains should have a free outlet. The cost of putting in 5-in. tile drains is given as $200 to $250 per mile.

Side ditches are necessary whether the tile is used or not. These should be broad rather than deep, with easy slope toward the road in order that vehicles may not be harmed if they get into these ditches. Water should not be carried long distances in these side ditches, but outlets should be provided at short intervals. Roads should be crowned sufficiently to provide for rapid surface drainage into the side ditches.

Where the roads are in excavation catch waters should be provided to keep drainage water off of the road. For maintaining the surface of roads in good condition, harrowing or dragging with a railroad rail, heavy timber, or split log is recommended.

The mixing of concrete, E. McCullough (*Sci. Amer. Sup., 61 (1906), No. 1580, pp. 25316–25318*).—The author states briefly the advantages of concrete over stone, calls attention to the necessity of thorough mixing, and compares hand mixing with various types of mechanical mixers. He favors the cube mixer.

Report of the commission on alcohol appointed by the minister of finance (*Jour. Agr. Prat., n. ser., 11 (1906), No. 15, pp. 454, 455*).—This commission, appointed to inquire into proper legislation for controlling the manufacture and sale of alcohol, recommended in regard to denaturized alcohol that: (1) In order to avoid adulteration the dealers should be required to label their goods in a conspicuous manner "denaturized alcohol, guaranteed 90 degrees;" (2) denaturized alcohol should have the benefits of reduced rates of transportation granted to refined petroleum; (3) that the vessels for denaturized alcohol which are returned empty to the shipper should be carried free on the state railroads, or pay the rates charged for merchandise of the fourth or fifth class on private lines; (4) so far as possible the formalities observed in the distribution, storage, and sale of denaturized alcohol should be simplified.

MISCELLANEOUS.

Sixteenth Annual Report of Arizona Station, 1905 (*Arizona Sta. Rpt. 1905, pp. 26*).—This contains the organization list of the station, a review of the work of the station during the year by the director, a financial statement for the fiscal year ended June 30, 1905, and departmental reports, some of which are noted elsewhere.

Annual Report of Idaho Station, 1905 (*Idaho Sta. Rpt. 1905, pp. 48*).—This includes a financial statement for the fiscal year ended June 30, 1905, a report of the director on the work and publications of the station during the year, and experimental work and meteorological observations abstracted elsewhere in this issue.

Eighteenth Annual Report of Indiana Station, 1905 (*Indiana Sta. Rpt. 1905, pp. 46*).—This consists of the report of the director and heads of departments, a list of periodicals received by the station library, a subject list of the bulletins of the station to date, and a financial statement for the fiscal year ended June 30, 1905. The report of the director contains a list of the cooperative experiments in progress July 1, 1905, and the report of the chemist an analysis of a sample of cattle food which was found to contain 96.73 per cent of sodium chlorid. The report of the horticulturist is noted elsewhere.

Eighteenth Annual Report of Kansas Station, 1905 (*Kansas Sta. Rpt. 1905, pp. 55*).—This contains a financial statement for the fiscal year ended June 30, 1905, a report of the council including abstracts of bulletins issued during the year, brief summaries of the work of the different departments not reported upon in bulletins, a report on the work of Fort Hays Branch Station, a statement concerning cooperative experiments with this Department, a subject list of station publications issued to date, and an index to the report and the bulletins issued during the year.

Fourteenth Annual Report of Kentucky Station, 1901 (*Kentucky Sta. Rpt. 1901, pp. XV + 308*).—This report, only recently issued, contains a financial statement for the fiscal year ended June 30, 1901, brief reports of the director and heads of departments for that year, miscellaneous chemical analyses and meteorological observations noted elsewhere, and reprints of Bulletins 91–97 of the station on the following subjects: Enemies of cucumbers and related plants (E. S. R., 13, p. 368); experiments with potato scab (E. S. R., 13, p. 360); the food of the toad (E. S. R., 13, p. 325); grapes (E. S. R., 13, p. 355); diseases of nursery stock (E. S. R., 13, p. 571); rabbits and their injuries to young trees (E. S. R., 13, p. 531); wheat (E. S. R., 13, p. 737); commercial fertilizers (E. S. R., 13, p. 730); the Hessian fly (E. S. R.,

13, p. 968); dangerous mosquitoes in Kentucky (E. S. R., 13, p. 971); poisonous and edible mushrooms (E. S. R., 13, p. 920), and commercial fertilizers (E. S. R., 13, p. 935).

Fifteenth Annual Report of Kentucky Station, 1902 (*Kentucky Sta. Rpt. 1902, pp. XVI+349*).—This contains a financial statement for the fiscal year ended June 30, 1902, a report of the director on the work of the station, including the fertilizer and food-control work, miscellaneous chemical analyses and meteorological observations noted elsewhere, and reprints of Bulletins 98–104 of the station on the following subjects: Kentucky forage plants (E. S. R., 14, p. 241); experiments with oats (E. S. R., 14, p. 242); inspection and analyses of foods (E. S. R., 14, p. 277); a comparison of feeds for pigs (E. S. R., 14, p. 283); analyses of commercial fertilizers (E. S. R., 14, p. 558); Hessian fly experiments (E. S. R., 14, p. 987), and analyses of commercial fertilizers (E. S. R., 14, p. 953).

Eighteenth Annual Report of Louisiana Stations, 1905 (*Louisiana Stas. Rpt. 1905, pp. 32*).—This contains reports of the Sugar Station at Audubon Park, New Orleans, the State Station at Baton Rouge, and the North Louisiana Station at Calhoun; statements concerning the work of the State geological survey and the United States Geological Survey in the State, and a financial statement for the fiscal year ended June 30, 1905.

Finances, meteorology, index (*Maine Sta. Bul. 124, pp. 227–268+VII*).—This bulletin consists of meteorological observations noted elsewhere, a financial statement for the fiscal year ended June 30, 1905, an index to the station reports for 1901–1905 and to bulletins 112–124, which collectively make up the twenty-first annual report of the station, and announcements and notes concerning the station.

Eighteenth Annual Report of Michigan Station, 1905 (*Michigan Sta. Rpt. 1905, pp. 81–539*).—This contains a financial statement for the fiscal year ended June 30, 1905; reports of the director and heads of departments, summarizing briefly some of the results of experiment station work during the year; meteorological observations noted elsewhere; and reprints of Bulletins 217–231 and Special Bulletins 24–33 of the station, which have already been noted.

Report of work at McNeill Branch Station, 1904, E. B. FERRIS (*Mississippi Sta. Bul. 87, pp. 16*).—Brief notes are given on weather conditions during the year and experiments with fruits, vegetables, and field crops are reported. The experimental work is abstracted elsewhere in this issue.

Eighteenth Annual Report of Vermont Station, 1905 (*Vermont Sta. Rpt. 1905, pp. 245–466*).—This includes the organization list of the station, a brief announcement concerning the station, a financial statement for the fiscal year ended June 30, 1905, a report of the director, abstracts of Bulletins 109–116 of the station issued during the year, and numerous articles abstracted elsewhere in this issue.

Abstract of Eighteenth Annual Report, 1905 (*Vermont Sta. Bul. 119, pp. 19–64, fig. 1*).—This is a résumé of the annual report of the station noted above.

Crop Reporter (*U. S. Dept. Agr., Bur. Statis. Crop Reporter, vol. 7, Nos. 11, pp. 95–102; 12, pp. 103–110*).—These numbers contain the usual statistics on the condition of crops in the United States and foreign countries and special articles on imported tobacco, exports of butter, imports of agricultural products into the United Kingdom, damage to the Cuban tobacco crop, the British market for Indian corn, and other topics.

Experiment Station Work, XXXIV (*U. S. Dept. Agr., Farmers' Bul. 251, pp. 32, fig. 1*).—This number contains articles on the following subjects: American sugar-beet seed, stimulants for seeds, profits from spraying potatoes, winter-injured fruit trees, durum wheat, fertility of eggs, indoor *v.* outdoor feeding of steers, roughage for steers, cheap dairy rations, and cotton-seed meal for hogs.

NOTES.

Colorado College.—A short course in horticulture was provided for by the State board of agriculture at its last meeting, to be held at Delta some time during the coming winter. This was done with the understanding that there would be at least fifty students regularly enrolled. One hundred have already signed the enrollment.

Delaware Station.—At a recent meeting of the board of trustees A. T. Neale was relieved of duty as director of the station, and was appointed in charge of the departments of agronomy and animal husbandry. This change went into effect July 1. A successor to Dr. Neale as director has not yet been elected.

Georgia Station.—Under the provisions of the Adams Act, the station proposes to inaugurate two new departments, i. e., departments of plant breeding and pathology (R. J. H. De Loach, of Athens, Ga., in charge), and of bacteriology. J. F. Monroe, of Guelph, Ontario, and P. N. Flint, of Cement City, Mich., have been made assistants in the departments of horticulture and animal industry, respectively.

Idaho University and Station.—Work is in progress on the new agricultural building, which is to be a brick structure 65 by 127 ft. in size and 3 stories high. The building will afford accommodations for the agricultural work of the university as well as the experiment station.

The people of Caldwell have donated 320 acres of land for an "auxiliary station," where experiments may be carried on under irrigation and dry-land farming.

Illinois University and Station.—The agricultural building at the university is undergoing an overhauling to secure space made necessary by the unexpected increase in students and by the demands of the station. The dairy department is now occupying the rooms made vacant by the removal of the household science department to the woman's building; the stock-judging room is being floored to provide an additional class room, and laboratories throughout the building are to be doubled in size.

A farm mechanics building, 100 ft. square and 2 stories high, is being erected. This will enable the entire southeast wing, which has been used for the farm mechanics work, to be fitted up for soil physics and crop work. When the agricultural building was erected there were but 19 students in agriculture and 7 instructors and investigators. Now the students have increased to 430, and there are 44 employees in the college and station—all within the space of 6 years.

Louisiana University and Stations.—E. Rosenthal, from the agricultural college, Madison, Wis., has been elected dairyman of the station at Calhoun. J. G. Lee, jr., of the class of 1906 of the university, has been placed in charge of feeding experiments at the station at Calhoun. H. R. Fulton has been elected to the position of plant pathologist at the station at Baton Rouge. Mr. Fulton is a graduate of the University of Mississippi, took his master's degree at Columbia, Mo., and has been taking work at Harvard the past year. H. J. Milk, of Watertown, N. J., has been elected bacteriologist of the stations, and will devote his time to the investigation of animal diseases.

The legislature passed a bill giving $50,000 for a new chemical laboratory for the university. The foundation is now being laid for a building to be devoted to experimental engineering.

Missouri Station.—Leonard Haseman, recently connected with the Florida University and Station, has been appointed assistant in entomology. C. R. Crosby, assistant in entomology, has gone to the New York Cornell Station.

Cornell University and Station.—T. L. Lyon, of the Nebraska University and Station, has been appointed agronomist in the station. W. A. Stocking, jr., for several years past connected with the Connecticut College and Storrs Station, has been elected assistant professor of dairy bacteriology in the college of agriculture.

The next winter dairy course at the university will open Thursday, December 6, and close Wednesday, February 27, 1907. This is about four weeks earlier than the course has been started heretofore. The change is made possible by the new dairy building and increased number of instructors for next year, which will permit both the long and short courses to be in progress at the same time. Nine-tenths of last year's class expressed themselves in favor of the earlier date.

Oklahoma College and Station.—At a recent meeting of the board of regents, A. T. Kruse, of Geary, Okla., appointed to succeed H. G. Beard, resigned, was elected treasurer of the board. E. H. Riley was relieved of station work to give all of his time to the school of agriculture and domestic economy. Roy C. Potts, a graduate of the Michigan Agricultural College, was appointed assistant in dairying in the college and station, vice C. H. Tourgee.

Texas College and Station.—John A. Craig resigned his position as dean and director July 1, and will give his attention to stock raising.

Vermont University and Station.—N. J. Giddings, a graduate in the agricultural department of the class of 1906, has been elected assistant botanist in the station to succeed W. J. Morse, who, as previously noted, resigned to accept a position at the Maine Station. H. A. Edson, a graduate of the chemical department of the class of 1906, assumes some of Professor Morse's college duties, and incidentally does some work for the station along botanical lines.

Virginia Station.—A large experimental orchard of dwarf apple trees on Doucin stocks was planted the past spring to determine the value of dwarf trees for commercial work. This orchard contains representatives of all the leading commercial varieties. This is the first orchard of its kind in the South, and the outcome is awaited with interest. The value of dwarf trees in relation to the horticultural operations of pruning, spraying, and harvesting is obvious, but questions of yield and hardiness in this climate are unsettled.

Extensive cooperative investigations relative to tobacco have been arranged for between the Bureau of Soils of this Department and the station. B. G. Anderson and W. L. Owen, graduates of the college of agriculture, have been appointed as the station's representatives to take charge of the cooperative work in the dark-tobacco belt at West Appomattox and in the light-tobacco belt at Chatham.

U. S. Department of Agriculture.—Dr. C. F. Langworthy, who has long been associated with the nutrition investigations assigned to this Office, formerly directed by Prof. W. O. Atwater, has been given general charge of this work, under the supervision of the director of the Office.

Dr. Ulysses G. Houck has been selected to have immediate charge of the new meat inspection work in the Bureau of Animal Industry. Dr. Houck was formerly a traveling inspector in the field. He will hereafter be located in Washington.

Dr. R. P. Steddom, chief of the Inspection Division of the Bureau of Animal Industry, will have immediate charge of the work on tick eradication provided for in the new appropriation act, and of the field work on the eradication of scabies in sheep and cattle.

Dr. Charles A. Browne, jr., recently chemist at the Louisiana Sugar Station at New Orleans, has been appointed chief of the sugar laboratory in the Bureau of Chemistry, this Department. He entered upon his duties early in July.

A. J. Pieters, in charge of the seed and plant introduction in the Bureau of Plant Industry of this Department, has announced his intention of resigning from the Department service in the early fall to engage in private business.

Cooperative Experiment Association of the Great Plains Area.—The first annual meeting of the Cooperative Experiment Association of the Great Plains Area was held at Lincoln, Nebraska, June 21–22, 1906. This association consists of those members of experiment stations who are interested in field-crop work in the States of North Dakota, South Dakota, Nebraska, Oklahoma, and the north of Texas, together with representatives of the Bureau of Plant Industry of this Department who are interested in experiments in crop rotation and tillage in that region. The association was organized at the time of the annual convention of the Association of American Agricultural Colleges and Experiment Stations at Washington in 1905, with B. T. Galloway as president and E. C. Chilcott as secretary.

This first annual meeting at Lincoln was a very successful one, both in point of attendance and the interest and enthusiasm manifested. Eleven members of the Department of Agriculture were present and about fifteen experiment workers. The following were among the papers read: Effect of Crop Rotation on Soil Fertility, J. H. Shepperd, North Dakota; Comparative Value of Corn and Summer Fallow in Alternation of Wheat, John S. Cole, South Dakota; Drought Resistance of Sorghum Crops, A. H. Leidigh, Bureau of Plant Industry, Amarillo, Texas; Seed Selection Essential in Crop Production under Semiarid Conditions, W. H. Olin, Colorado; Proposed Physical Investigations in connection with the Cooperative Cultivation Experiments, L. J. Briggs, Bureau of Plant Industry; Crop Production in Western Kansas, O. H. Elling, Fort Hays, Kansas. These papers and many other subjects of similar nature were informally discussed.

The visiting members were given an opportunity of seeing the work of the Nebraska Station, and a luncheon was tendered them by the Lincoln Commercial Club. Director E. A. Burnett was elected president for the ensuing year, and E. C. Chilcott, reelected secretary. Manhattan, Kansas, was chosen as the place of holding the next summer meeting.

Society for Horticultural Science.—At the Cornell meeting of the society, June 27 and 28, W. T. Macoun spoke on The Relation of Winter Apples to Hardiness of the Tree. To withstand a test winter at Ottawa, a tree or shrub must ripen its wood early. Winterkilling is liable to be more severe after a season when the growth has been strong than when it has been short. The more moderate the climate where a variety originates, the less resistant is it to winterkilling. The hardiest varieties of apples are those that have originated in Russia and are summer or autumn varieties. This is because they ripen their wood most thoroughly, whereas winter varieties continue growth later in the season. The basis for the production of the desired winter apple for the North should be a variety which has withstood test winters in a similar climate and is also the latest keeper of such varieties.

William Stuart presented a general discussion of the use of anesthetics in the forcing of plants, and summarized his own experiments with rhubarb. (See E. S. R., 17, p. 250.)

In a paper on Pollination Methods, S. W. Fletcher presented a symposium of his own experience and that of a considerable number of other plant breeders. The ideal time to emasculate blossoms is as late as possible before the anthers dehisce, but may be done when the buds are still quite small. If complete accuracy is not essential, and when working on blossoms that do not mature stamens and pistils simultaneously, the blossoms need not be emasculated. In crossing, select mature trees of moderate growth and perfectly sound. On such trees select buds borne high up on the outside of the tree on well-nourished branches on the side of the tree opposite from the direction of severe prevailing winds. As to the instruments for emasculating, in the majority of cases a small scalpel is to be preferred, especially for the stone and pome fruits. As to the location of the cut, the majority opinion is that it should be made at the insertion of the stamens above the nectary, though the author

himself prefers to make it as high up as possible. The safest time to pollinate is near the beginning of the receptive condition of the pistils or perhaps twenty-four hours before. A receptive stigma usually glistens when it catches the sunlight and in most fruits it is beginning to be slightly brownish. Brush pollinating is often most practicable when many blossoms must be pollinated in a short time. For our common trees, however, some workers use the thumb or forefinger. As to the percentage of successes, seven pollinators of experience placed their averages variously at from 50 per cent down.

Some phases of pollination were presented by N. O. Booth. The period during which fresh pollen is available for study may be lengthened by forcing twigs in the laboratory. If pollen is taken from the orchard at the normal blooming season it is advisable to take twigs with still unopened buds and let them open indoors. This assures freedom from foreign pollen. Very few apple varieties have the pollen all good and none so far all bad, most varieties showing different proportions of mixed forms. Pollen from the same tree may differ with the condition of the tree. Tompkins King and Esopus Spitzenburg among others have notably weak pollen and are successfully raised only in neighborhoods where conditions are favorable for pollen production. Varieties with particularly strong pollen, as Jonathan and Ralls, are of wide adaptation and are often liable to overbear, the fruits being consequently undersize.

F. W. Card presented a symposium of experience as to the advantage of double-working apples on vigorous stocks. The value of top-working to increase hardiness of stock in a trying climate is unquestioned. It markedly reduces injury from certain diseases. Northern Spy, especially, promises to reduce injury from the woolly aphis in the South. Weak-growing varieties are benefited by the practice. Early bearing can be promoted by top-working on a weak stock, although at the expense of productiveness and doubtless of longevity. But for ordinary varieties in favorable regions the advantages of top-working are outweighed by the disadvantages.

Earle J. Owen discussed The Importance of Selection in Plant Breeding, citing several striking examples of its application.

L. C. Corbett raised the query, What is to be the Future Application of the Term Horticulture? To the already recognized subdivisions of horticultural interests in America, namely, olericulture, pomology, floriculture, and landscape gardening, the author would add plant breeding and plant propagation. Under the latter head is comprised nursery work and the increasing of annual plants from seed or from herbaceous cuttings.

H. J. Eustace gave an account of investigations on apple decays in commercial cold storage. Several varieties of apples were inoculated with black rot, brown rot, bitter rot, soft rot or blue rot, and a species of Alternaria, and at once put in cold storage at a constant temperature of 30 to 32° F. At the end of two months none of these diseases had developed except the soft or blue rot. Later, when the inoculated fruit was taken out of storage, the other diseases also developed, showing that the low temperature of the cold storage simply retarded the fungi in their development but did not destroy them. In another experiment, where the temperature ranged from 37 to 56°, decays developed slowly, except the soft rot; but when the temperature ranged from 54 to 65.5° all decays developed and in most cases very rapidly. Peaches similarly inoculated and held in cold storage two weeks developed decays in about one-half of the specimens.

Prof. W. R. Lazenby read a paper on the use of colored cloth in shading plants. Cabbage, tomato, lettuce, and geranium plants, as well as seeds of corn, peas, beans, and radishes were grown under ordinary white cheese cloth shade, as well as cheese cloth colored black, red, blue, and yellow. Corn and bean seeds came up most readily under the black cloth, but the plants under both black and red cloth soon

began to show weakness and decline in rate of growth. The early shading of rhubarb with black cloth gave excellent results in lengthening the petiole and diminishing the size of the leaf blade. On the whole, the observations indicate "that black bunting may be profitably used as a shade in early spring and possibly at a later date on certain crops, like celery, cauliflower, etc. It may also hasten the maturity of certain vegetables, like tomatoes, when used after the plants or fruit are well developed." Other benefits from shading are the protection of the plants from frost, and from certain insects, like the radish fly and beetle.

H. P. Gould described the recording of phenological data for pomological uses as carried on by the U. S. Department of Agriculture for several years past.

Abstracts of L. H. Bailey's address on The Field for Experiment in Horticulture and John Craig's paper on Plant Growing by Artificial Light were not obtained.

Forestry Instruction at Armstrong College.—The forestry branch of Armstrong College, Newcastle-on-Tyne, has been given charge of the local management of Chopwell Woods in the county of Durham. These woods are within a few miles of the college and contain nearly 900 acres of larch, spruce, Scotch pine, oak, ash, and other trees, most of which were planted about 50 years ago. A house is being built in the woods for the college lecturer in forestry, and arrangements made for the holding of short courses for practical foresters. It is believed that this addition to the college will make it one of the most favorable centers for forestry instruction in the United Kingdom.

Macdonald College.—The New York *Evening Post* is authority for the statement that Sir William Macdonald has completed arrangements for transferring the new Macdonald College, at St. Anne de Bellevue, near Montreal, which was established by him, to McGill University. The property is valued at between $2,000,000 and $3,000,000, and has a fund amounting to $2,000,000. It is the founder's wish that it should rank as a college of McGill University.

A New Sugar School.—A professional sugar school was opened at St. Ghislain, Belgium, May 1, 1906, with 12 students in attendance. The course of study includes the following subjects: Physics and general chemistry; analytical and applied chemistry; sugar technology, sugar chemistry, and sugar legislation; general mechanics and industrial electricity; mathematics; sugar accounts; geometrical drawing, industrial drawing, and industrial economy. The course covers two years and leads to a diploma.

Irish Scholarships in Agriculture.—The Department of Agriculture and Technical Instruction for Ireland offers scholarships at the Royal College of Science in Dublin and the Albert Agricultural College, Glasnevin, each scholarship to include free tuition for one year, a third-class railway fare to and from college, and either a maintenance allowance of $5.00 a week if in attendance at the Royal College of Science or free board and lodging at the Albert Agricultural College. The scholarships are good for one year, but may be renewed for two or three years to enable students to complete the agricultural course.

A Summer School Course in Children's Gardens.—The New York University is conducting a six weeks' course in children's gardens in connection with its summer school, which opened July 2. The course is under the direction of Henry Griscom Parsons, Assistant Director of Children's Gardens in New York, and about 25 young women have been enrolled.

School Gardens in England.—According to a recent report in the *Agriculturist Economist* there are in Surrey County, England, under the control of the Surrey Education Committee, 61 sets of children's gardens attached to the elementary schools, where no less than 1,000 boys are being taught practical gardening. Tools and seeds are supplied and a capable instructor is employed.

Miscellaneous.—The degree of doctor of science was conferred upon Dr. A. C. True, director of this Office, by Wesleyan University.

Dr. D. E. Salmon, formerly chief of the Bureau of Animal Industry of this Department, has accepted an offer of the Government of Uruguay to organize a bureau of animal industry for that government, and will proceed to that country next December.

Prof. William Schlick, of St. John's College, Oxford, has been constituted professor of forestry.

W. P. Wright, horticultural instructor in Kent County, has been appointed superintendent and lecturer of the horticultural department of the Southeastern Agricultural College at Wye, England. A definite course along this line is to be established at the college.

The Cuban Government has recently instituted an official publication of the secretary of agriculture, industry, and commerce, entitled *Boletin Oficial de la Secretaria de Agricultura, Industria y Comercio*, Vol. I, No. 1 of which has been received. It is announced that the experiment station will be a contributor to this publication, and the first number gives the full organization of the station, which includes 21 persons.

Le Bambou is the name of a new French monthly publication, which is to be devoted entirely to the study, culture, and uses of bamboo. It is published at Mons, Belgium, by the editor, Jean Houzeau de Lehaie. The first number was issued January 15, and contains 40 octavo pages.

The Rhine Province Dairy Institute at Zülpich was removed to Griethausen, near Cleve, on April 1, 1906.

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EXPERIMENT STATION RECORD.

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The second session of the Graduate School of Agriculture, held at the College of Agriculture of the University of Illinois, July 2-28, was a marked success from beginning to end. As is generally known the graduate school has been adopted by the Association of American Agricultural Colleges and Experiment Stations, and the colleges represented in that organization tax themselves for its support. In its general management of the enterprise, the association is represented by its standing committee on graduate study, of which Director L. H. Bailey, of Cornell University, is chairman. The University of Illinois very generously extended an invitation to hold the school under its auspices this year, and its success was due in no small measure to the excellent facilities afforded by the College of Agriculture and the efforts of its personnel. Dr. A. C. True, Director of the Office of Experiment Stations of the U. S. Department of Agriculture, was again selected as dean of the school, and Prof. Eugene Davenport, dean of the College of Agriculture of the University of Illinois, acted as registrar. Courses were given in agronomy, horticulture, plant physiology and pathology, zootechny, and plant and animal breeding, with special reference to the production of plants and animals suited to the conditions in the Mississippi Valley and the Great Plains. These included lectures and seminars, but no laboratory exercises.

The faculty consisted of 35 of our leading agricultural teachers and investigators, including 5 officers of the U. S. Department of Agriculture, 12 members of the faculty of the College of Agriculture of the University of Illinois, and 18 professors and experts from 16 other agricultural colleges and experiment stations. Aside from these there were several outside men who lectured at the school, among whom were the statistician of the Union Stock Yards at Chicago, representatives of a large commission house in Chicago and of Swift & Co., Maj. David Castleman, who spoke on the breeding of saddle horses, and Mr. N. H. Gentry, the famous breeder of Berkshire pigs.

The total enrollment of the school was 131, of whom 91 were classed as students. These came from 34 States and Territories. Hungary was represented by a professor from the University of Budapest, and

there were three students from India. In addition, there were a considerable number of persons who came as visitors, to attend the exercises for a few days, who were not registered. The attendance, therefore, considerably exceeded that of the previous session, at Ohio State University, at which 75 students were registered.

The opening exercises of the school were held on the evening of July 4, when the school was welcomed to the University by Dr. T. J. Burrill, vice-president of the University. Prof. L. H. Bailey presided and made an address in which he pointed out the need of a comprehensive system of agricultural education comprising institutions or departments for research, graduate study, college courses, extension work, and secondary and elementary courses. The graduate school is needed to aid in the more complete establishment of such a system and to stimulate workers in our agricultural institutions to more thorough study and research.

Dr. A. C. True gave a short history of the graduate school and pointed out the great development of agricultural education and research in this country since the first session of the school was held four years ago. He also called attention to the pressing need for more trained workers in different branches of agricultural service. The claim was made that the battle for adequate recognition of agriculture in our higher institutions of learning is essentially won and that our leading educators are convinced that agriculture in some form should constitute part of the industrial element of public school education. It was pointed out that so great is the public interest in agricultural education and research that funds are coming to our agricultural institutions fully as fast as they can be utilized, and that a very great responsibility is being laid on our agricultural teachers and scientists to make the best use of the money put in their hands.

A paper by Dr. H. W. Wiley, Chief of the Bureau of Chemistry of the U. S. Department of Agriculture, was also presented, in which the meager opportunities for study along agricultural lines in preparation for the doctor's degree at our leading universities were shown. These were contrasted with the wider opportunities for such work offered in the German universities and the greater extent to which advanced study in agricultural lines is encouraged. Dr. Wiley declared that "there are no problems of a strictly scientific character which at the present time have more intimate relations to the welfare of the people than those which are connected with agriculture. The field of research also in this region is more fruitful, the number of problems greater, and the opportunities for discovery wider than in almost any other field of scientific investigation. The establishment of agricultural colleges and experiment stations is giving proper training to a vast body of young men, many of whom ought to enter the university and continue

the studies of their college days. . . . What the friends of agriculture should ask is that in the future our great universities should recognize agricultural science as one of the leading branches to which attention should be paid in graduate studies."

Several conferences and informal meetings were held during the session of the school, and a National Association of Dairy Instructors and Investigators was formed. A conference for the discussion of general questions relating to the organization of agricultural education and research was held July 7. Dean Davenport outlined the organization of the College of Agriculture of the University of Illinois. The system followed there involves the division of authority and work in such a manner that definite responsibility is laid on officers in the several departments and full credit is given for each man's share in the work. Questions involving "team work" are discussed at meetings of the workers, and every effort is made to secure full agreement on plans before their execution is attempted. In order to secure financial and moral support for the college and station the farmers' organizations throughout the State are taken into confidence, and the responsibility for the proper maintenance of the institution is laid on their shoulders.

Professor Bailey argued in favor of the establishment of regular provision for agricultural studies leading to the doctor's degree in our universities and would make this a matter to be controlled by the university rather than by the college of agriculture. He also favored the simplification of degrees and would have Ph. D., M. S., and B. S. (or M. A. and B. A.) the only degrees to be conferred in course. This suggestion met with much approval from members of the graduate school.

Dr. W. H. Jordan, director of the New York State Experiment Station, spoke very earnestly of the need of more thorough scientific research along agricultural lines, and impressed his hearers with the great importance of maintaining the strictest integrity in making and recording agricultural investigations.

Dr. W. O. Thompson, president of Ohio State University and one of the founders of the graduate school, gave a brief account of the origin of the school, and expressed his strong belief in its value as an aid to broadening and strengthening our system of agricultural education. He predicted that it would have a career of increasing success and usefulness. Dr. Brown Ayres, president of the University of Tennessee, spoke from the standpoint of one interested in general educational advancement, and emphasized the importance of the movement for the development of a thorough system of agricultural education.

A conference on extension work in agriculture was held July 21, at which great interest in this feature was developed. Resolutions

favoring the aid of the Office of Experiment Stations in this direction were adopted.

A meeting of dairy instructors and investigators July 17–19 resulted in the formation of a national organization, as mentioned above. At this meeting a regular programme was presented, covering the whole range of dairy teaching and experimentation. The papers and discussion brought out the urgent need of scientific investigation to solve many practical problems in dairying and in the feeding of dairy cattle. Emphasis was placed on the demand for more and better trained men in dairy work, and on raising the standard of dairy instruction. Prof. R. A. Pearson, of Cornell University, was elected president of the association, C. B. Lane, of the U. S. Department of Agriculture, secretary-treasurer, and committees were appointed upon various topics.

Informal meetings were held several evenings at which questions relating to various phases of agricultural education were discussed. Among these were the methods of teaching agronomy, the organization of secondary and elementary courses in agriculture, and the science of agriculture as a basis for the organization of a system of agricultural education. These meetings were to some extent a continuation of the daily sessions and seminars. This atmosphere of discussion of matters of fundamental importance in agricultural education and research was probably one of the most beneficial features of the school.

On Saturday, July 14, about 70 members of the school visited the estate of the Funk Bros., near Bloomington, Ill., comprising about 25,000 acres, where crop and animal production on a large scale was seen under the best conditions, as well as considerable experimental work in breeding oats and corn.

When news came of the death of Hon. H. C. Adams, the school adopted resolutions expressing their appreciation of the services rendered to the cause of agricultural education and research by Mr. Adams, in securing the passage of the act "which will forever bear his name and associate him in the minds of our people with Senator Morrill, of Vermont, and Representative Hatch, of Missouri, through whose wise statesmanship our agricultural colleges and experiment stations have been established and maintained."

The interest in the work of the school was well sustained throughout the session. There was considerable going and coming of students, a few even registering during the last week. Even those who stayed only a few days seemed to feel that they had received inspiration and information which made their coming to the school worth while. The students were unanimous in their expressions of the benefits and the broadening influence of the school, and in the general hope that another session might be held two years hence.

RECENT WORK IN AGRICULTURAL SCIENCE.

AGRICULTURAL CHEMISTRY.

The examination of materials important in agriculture and the industries, J. König (*Die Untersuchung landwirtschaftlich und gewerblich wichtiger Stoffe. Berlin: Paul Parey, 1906, 3. ed., rev., pp. 1100, pl. 1, figs. 352*).—This is the third revised edition of this practical handbook of methods of examination of soils, manures and fertilizers, ashes, feeding stuffs, seeds, milk and dairy products, fats and oils, honey; materials and products of sugar, starch, spirits, beer, and wine making; water, dust and smoke injurious to vegetation, wool, beeswax, lubricants, etc.

New official Italian methods of analysis of fertilizers, L. Sicard (*Ann. École Nat. Agr. Montpellier, n. ser., 5 (1906), No. 4, pp. 300–323*).—The methods adopted by the directors of the agricultural experiment stations and laboratories of Italy in convention held in Rome in July, 1904, are described and critically discussed and compared with other methods for the same purposes. These include general methods of determining moisture, nitrogen, total phosphoric acid, potash, and iron and aluminum oxids, and methods of analysis of special fertilizers, such as superphosphates, aluminum phosphate, Thomas slag, ammonium sulphate, sodium nitrate, and farm manure.

A further note on the determination of phosphoric acid by the citrate method, V. Schenke (*Landw. Vers. Stat., 64 (1906), No. 1, pp. 87–91; abs. in Chem. Centbl., 1906, I, No. 19, p. 1573*).—This is a reply to criticisms of the author's method by F. Mach (E. S. R., 17, p. 731), in which further analytical data in substantiation of the accuracy of the method are reported.

A method of detection and determination of small quantities of iron, A. Mouneyrat (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 19, pp. 1049–1051*).—A colorimetric method based upon the green coloration produced when hydrogen sulphid is passed through an alkaline solution of iron is described. It is claimed that the method is applicable to solutions containing from 1 part of iron to 1,000 parts of solution to 1 part to 100,000, and is more sensitive than the sulphocyanid method, being especially applicable in biological investigations.

Tables for use in nitrogen and protein determinations, F. E. Hepner (*Wyoming Sta. Rpt. 1905, pp. 61–71*).

The determination of nitrogen in milk, M. Popp (*Milchw. Zentbl., 2 (1906), No. 6, pp. 263–268*).—This report of experiments concludes with the following outline for determining nitrogen in milk: Into a short-necked digestion flask are put 10 gm. of milk (measured with a pipette), 25 cc. of pure concentrated sulphuric acid, 1 to 2 gm. of mercury, and some sharp-cornered pieces of glass. After heating gently for 10 minutes, 10 gm. of potassium sulphate is added and the mixture boiled for 30 minutes. After cooling and transferring to the distillation flask, 5 gm. of zinc dust is added and also the necessary sodium hydroxid when the distillation and determination are made in the usual way.

The laboratory book of dairy analysis, H. D. Richmond (*London: C. Griffin & Co., Ltd., 1905, pp. VIII+90*).—This handbook on the composition and analysis of milk is intended for both the dairy manager and the trained chemist.

New rapid method for the determination of fat in milk without the use of acid, N. Gerber (*Rev. Gén. Lait, 5 (1906), No. 14, pp. 318–321*).—In this method, designated the salt method, the same apparatus is used as in the Gerber acid method, but the casein is dissolved by means of an alkaline solution, the exact composition of which is at present secret. Comparative determinations by the salt and acid methods are reported. They show very close agreement.

The salt method, M. Siegfeld (*Molk. Ztg., 20 (1906), No. 14, pp. 371–373*).—The salt mixture used in dissolving the casein in this new Gerber method is said to consist of sodium chlorid, sodium hydroxid, Rochelle salt, and a small quantity of coloring matter.

A solution is made by dissolving 230 gm. of this mixture in 1 liter of water. Eleven cc. of this solution, 10 cc. of milk, and 0.6 cc. of isobutylalcohol are mixed in the acid butyrometer, which is then placed in a water bath at 45° C. for 3 minutes and then centrifuged for 3 minutes. The reported results by the salt method are essentially the same as those by the acid method. The salt method is said to be uninfluenced by the presence of formalin or potassium bichromate in the milk.

On the importance of determining the freezing point in milk analysis, A. A. Bonnema (*Pharm. Weekbl., 43 (1906), No. 18; abs. in Rev. Gén. Lait, 5 (1906), No. 15, pp. 346, 347*).—The average freezing point of fresh cows' milk was found to be —0.555° C., which was increased as much as 0.02° by allowing the milk to stand for several hours or by boiling. Lactic fermentation lowered the freezing point. The importance of cryoscopy in detecting adulteration of milk is discussed.

The detection of cocoanut oil in butter, A. W. Thorp (*Analyst, 31 (1906), No. 363, pp. 173–175*).—The author determines the Reichert-Wollny number in the usual way, then adds 110 cc. of water to the flask, and distills off a second 110 cc. and titrates this with tenth normal sodium hydroxid. The insoluble volatile acids are then dissolved in 100 cc. of 90 per cent alcohol slightly warmed and this is also titrated with the tenth normal soda solution.

The number of cubic centimeters of the tenth normal soda solution required in the 3 determinations were respectively 29.2, 3.1, and 7.6 for normal butter and 8, 4, and 34 for cocoanut oil. The addition of 10 per cent of cocoanut oil to butter increased the third determination to 10.2 and the addition of 90 per cent to 29.1. In no instance did the alcoholic solution show a higher number than 8.4 for pure butter.

Plant lecithin; a preliminary communication, E. Winterstein and O. Hiestand (*Ztschr. Physiol. Chem., 47 (1906), No. 4–6, pp. 496–498*).—From their studies of the lecithin of cereals, lupines, and grasses, the authors are of the opinion that the name lecithin should no longer be applied to the organic bodies containing phosphorus, which occur in plants and are soluble in ether and alcohol, but that they should be termed phosphatides as has been suggested for similar products of animal origin.

Experiments on amino acids, polypeptids, and proteids, E. Fischer (*Ber. Deut. Chem. Gesell., 39 (1906), pp. 530–610*).—The cleavage of proteids yields, in addition to ammonia, albumoses, peptones, and finally amino acids. Albumoses and peptones are complex bodies but the acids are comparatively simple and the study of the chemical structure of proteids has been approached through this group.

The investigations have included synthesis and other studies of such acids, and several new and important methods of working with them and other products of proteid hydrolysis have been evolved. The general purpose of the author's work at present is to unite two or more amino acids to form a complex molecule and in this he has been successful and about 70 such bodies have been produced by his methods. The name polypeptids is proposed for these compounds, which are designated dipeptids, tripeptids, etc., according to the number of acid radicals entering into their structure. A tabular list of polypeptids is given. As a class polypeptids exhibit many

characteristics of proteids and in general it may be said that the author at present believes that albumins are polypeptids as regards structure.

The identification of sugar in mace and in cinnamon, E. SPAETH (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 8, pp. 447–450*).—A controversial article in which the author again states that sugar is a normal constituent of mace and cinnamon and summarizes data regarding its occurrence and estimation.

A new method of estimating organic phosphoric acid in flour and flour products, C. ARRAGON (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 9, pp. 520, 521*).—The proposed method consists essentially in extracting organic phosphorus with alcohol, igniting the residue obtained after evaporation, and determining the phosphorus as magnesium pyrophosphate.

The detection of sawdust in flour and bread, P. PAGANINI (*Gior. Farm. e Chim., 54 (1905), pp. 5–11; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 9, p. 530*).—The method of detecting sawdust depends upon the fact that wood when treated with paraphenylendiamin and acetic acid gives an orange-red color. Neither wheat flour nor corn meal gave such reaction.

The brown deposit found on aluminium vessels in which water has been boiled, C. FORMENTI (*Chem. Ztg., 29 (1905), No. 55, p. 746; abs. in Hyg. Rundschau, 16 (1906), No. 10, p. 557*).—The brown deposit, the author states, is graphite-silicic acid, and is harmless.

METEOROLOGY—WATER.

Report of the meteorological council (*Rpt. Met. Council [Gt. Brit.], 1905, pp. 227, pls. 2, fig. 1, map 1*).—This consists as usual of administrative reports regarding organization and operations (during the year ended March 31, 1905) in marine meteorology, forecasts and storm warnings, climatology, publication, and miscellaneous subjects, with appendixes relating to conspicuous meteorological occurrences in 1904, operations of the office in the 50 years since 1854, lists of logs and other documents received during the year, reports on inspections of meteorological stations, accessions to the library, list of persons and institutions to whom publications are sent, distribution of instruments, and financial statement.

The methods of distribution and the accuracy of weather forecasts are discussed, and it is shown that during the year 1904–5 57 per cent of the forecasts were completely successful, 31 per cent partially successful. The averages for 1895 to 1904 are 55.5 per cent completely successful, 28.2 per cent partially successful. The percentage of successful storm warnings in 1904 was 89.8.

The work of the station of agricultural climatology of Juvisy during 1905, C. FLAMMARION (*Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 4, pp. 433–455, figs. 6*).—A record is given of observations on atmospheric pressure, temperature of the air, soil, and underground water, relative humidity, rainfall, sunshine, and radiation, in continuation of those of previous years (E. S. R., 17, p. 440). Studies of the effect of different rays on plants and animals were also made as in previous years. Inconclusive studies of the influence of the moon on the germination and growth of various crops which have been noted elsewhere (E. S. R., 17, p. 532) are recorded.

The general course of the temperature of the air and of the soil at depths of 0.25, 0.5, 0.75, 1, and 1.5 meters was analogous throughout the year. During October, November, December, January, and February there was a series of rising temperatures which increased with the depth in the soil; in May, June, July, and August a series of falling temperatures which decreased with the depth. The temperature curves thus crossed in spring and again in autumn. The mean temperature of the water in wells about 14 meters deep was 11.3° C., 1.6° higher than that of the air, and the annual variation in temperature was 1.4° C.

Meteorological records for 1904 (*New York State Sta. Rpt. 1904, pp. [illegible]–441*).—Tables are given which show the average monthly precipitation since 1882; average

monthly temperature since 1882; tridaily readings of the standard air thermometer during each month of 1904; a monthly summary of maximum, minimum, and standard thermometer readings; and daily readings of maximum and minimum thermometers at 5 p. m. for each month of the year.

Meteorological summary, C. B. Ridgaway (*Wyoming Sta. Rpt. 1905, pp. 76, 77*).—A summary of observations at Laramie, Wyo., on temperature, atmospheric pressure, precipitation, evaporation, and direction and velocity of the wind during the year 1904. The mean temperature for the year was 41.9° F., the highest 83, July 12 and 15, the lowest −16, January 28; the mean barometric pressure was 23.024 in.; the total precipitation was 9.58 in., the mean for the past 10 years being 9.8 in.; the evaporation from May 7 to September 15 was 1.866 ft.

The climate of Naples during the meteorological year 1903–4, E. Annibale (*Bol. Soc. Nat. Napoli, 1. ser., 19 (1905), pp. 65–96*).—Observations on atmospheric pressure, temperature, humidity, precipitation, direction of the wind, cloudiness, and storms are summarized and discussed.

The rainfall régime and crops in Russia, H. Sagnier and E. Tisserand (*Bul. Soc. Nat. Agr. France, 66 (1906), No. 1, pp. 32–38*).—Statements by A. Yermoloff regarding the dependence of crops, particularly wheat, upon the amount and distribution of spring rains, especially in central Russia, and the failure of crops in seasons of deficient or badly distributed rainfall, are reported and commented upon.

Weather forecasting (*Abs. in Rev. Gén. Sci., 17 (1906), No. 8, pp. 350, 351*).—A report by Durand-Gréville to the Belgian Astronomical Society on laws of storm movements in relation to weather forecasting is briefly reviewed, and a plea is made for a better system of weather forecasting in France.

Protection of crops against hail in 1905 by means of cannon and bombs, H. Dufour (*Chron. Agr. Vaud, 19 (1906), No. 7, pp. 198–207*).—The results of the campaign of 1905 are briefly summarized and the present status and possibilities of this method of protection are discussed.

On the construction of isobaric charts for high levels in the earth's atmosphere and their dynamic significance, J. W. Sandström (*Trans. Amer. Phil. Soc., 21 (1906), No. 2, pp. 31–95, pl. 1, figs. 15*).—It is shown how such charts can be constructed from meteorological observations obtained by means of kites and balloons in the free air, and the connection of the charts with the dynamics of the atmosphere is discussed. "It is to be expected that upon such maps we may easily and naturally present our observations and experience as to atmospheric movements and, therefore, it would seem to promise good results if the daily weather predictions could be based upon such maps."

The gases of the atmosphere, W. Ramsay (*New York and London: The Macmillan Co., 1905, 3. ed.; rev. in Chem. News, 93 (1906), No. 2422, p. 199*).—The principal new feature of this edition is a chapter on radio-activity and radio-active gases.

Water and its use for industrial and technical purposes, E. Leher (*Das Wasser und seine Verwendung in Industrie und Gewerbe. Leipsic: G. J. Göschen, 1905, pp. 124, figs. 15*).—A concise treatise on the occurrence, physical and chemical properties, and testing of water, the technology of water for potable purposes, steam boilers, and special technical processes, water storage, and the disposal of sewage.

The culture of anaerobic micro-organisms as applied to water analysis, A. Guillemard (*Ann. Inst. Pasteur, 20 (1906), No. 2, pp. 155–160, fig. 1*).—It is claimed in this article that present methods of bacteriological examination of water are defective in that account is taken only of the number of organisms which develop in the presence of air and that the probably equally important anaerobic organisms not taken into consideration. A method for studying the relation between ic and anaerobic organisms in water is described, especially the apparatus and d to be used in the culture of anaerobic organisms in an atmosphere of hydrogen.

use of copper sulphate in water filtration, H. W. Clark and S. DeM.

GAGE (*Jour. Infect. Diseases, 1906, Feb., Sup. 2, pp. 172-174*).—Investigations are briefly reported which indicate that the use of copper sulphate as a preliminary treatment in the purification of sewage results in a lowering of the efficiency of subsequent filtration and bacterial purification of the filter bed.

On the bactericidal action of copper, H. W. CLARK and S. DEM. GAGE (*Jour. Infect. Diseases, 1906, Feb., Sup. 2, pp. 175-204*).—An account is here given of a series of experiments in which waters were treated with definite amounts of copper or copper sulphate or placed in contact with metallic copper and allowed to absorb an unknown amount of copper. The efficiency of the treatment was measured by its effect on the total number of bacteria and on the numbers of *Bacillus coli* and *B. typhosus* in the water.

The conclusion is reached that the treatment of water with copper sulphate or by storing in copper vessels has little practical value because it is not absolutely effective and is therefore dangerous in the hands of the general user. It was found in some cases that in order to insure the complete destruction of *B. coli* and *B. typhosus* it was necessary to use copper sulphate at the rate of 1 part to 1,000 of water, in which case the water was of a strongly astringent taste and would be repugnant to the user. Allowing water to stand in copper vessels for short periods was occasionally effective in removing *B. coli* and *B. typhosus*. In other cases, however, the very dilute solutions of copper sulphate or colloidal copper absorbed from contact with clean metallic copper appeared to have a decidedly invigorating effect on bacterial activity.

The resistance to decomposition of certain organic matters in sewage, H. W. CLARK (*Jour. Infect. Diseases, 1906, Feb., Sup. 2, pp. 136-138*).—It is shown in this article that a certain small percentage of exceedingly stable carbonaceous and nitrogenous matter accumulates year after year in filters used for ordinary domestic sewage and seriously impairs their efficiency. This material was found to resist nitrification and is believed to be of a carbonaceous rather than nitrogenous nature.

Biological purification of sewage waters, RICHE (*Ann. Chim. Analyt., 11 (1906), Nos. 1, pp. 16-19; 2, pp. 64-69*).—The importance of biological processes as compared with chemical methods is discussed and various methods in which biological processes play a prominent part are considered, especially from the standpoint of disposal of Paris sewage. These include irrigation, and filter bed, septic tank, the Candy (intermittent sprinkling and carboferrite) method of treatment, and others.

A consideration of the difficulties in the way of disposing of the Paris sewage by means of irrigation leads to the conclusion that the only solution of the problem appears to be a combination of bacterial purification and irrigation.

Recent views of the sewage disposal problem (*Engin. Rec., 53 (1906), No. 4, pp. 87, 88*).—This is a brief editorial review of the recent rapid progress in this field, which is ascribed largely to progress in adopting better methods of sewage analysis, which yield fairly comparable results.

It is stated that "the old idea that sewage farming is the best method of disposal was exploded long ago, and the sewage farms still in service are not kept in operation because they afford the most economical method of treatment, as a rule. The rise of intermittent filtration has similarly reached its culmination. It is acknowledged to be the most perfect method of treatment when all conditions are favorable, but it is now known that it is much more expensive than was formerly anticipated, and the character of the effluent which it furnishes is often unnecessarily good for discharge into the body of water receiving the purified sewage. . . .

"Under these circumstances specialists in sewage treatment have been working to ascertain just what methods are best for securing different degrees of purification from the partial clarification resulting from simple sedimentation to the extreme

degree of purification attained with the best intermittent filters under the best operating conditions. . . .

"Along with this recognition of the varying requirements of sewage treatment are many new suggestions concerning the methods to be followed. The most interesting of these to the engineer who has not been following the development of the subject, is the closer connection which is gradually appearing between the principles of water purification and sewage treatment."

Present practice in sewage disposal (*Engin. Rec., 53 (1906), No. 4, pp. 97, 98*).—This is a summary of a paper presented by G. W. Fuller at a recent meeting of the New Jersey Sanitary Association.

The paper emphasizes the desirability of preparatory treatment with raw sewage to remove the sludge, combinations of methods of purification, and treatment of the effluents with copper sulphate or other germicides, and describes comparative tests which have been made by the city of Columbus, Ohio, of various methods of sewage disposal. The preparatory treatment found most effective in these trials was afforded by septic tanks holding an average flow of about 8 hours, followed by the use of sprinkling filters operating at an average rate of 2,000,000 gal. per acre daily.

The collection and preservation of samples of sewage for analysis, S. DEM. GAGE and G. O. ADAMS (*Jour. Infect. Diseases, 1906, Feb., Sup. 2, pp. 139–148*).—Chloroform in amounts of 10 to 25 cc. to each gallon bottle is stated to be a good preservative for samples of sewage which are to be kept for some time before analysis.

SOILS—FERTILIZERS.

Some new properties of soils, J. KÖNIG, J. HASENBÄUMER, and E. COPPENRATH (*Landw. Vers. Stat., 63 (1906), No. 5–6, pp. 471–478*).—This article discusses briefly the effect of steam on soils and the catalytic power and osmotic pressure of soils.

It is shown that by heating 250 gm. of a soil with 3 to 4 liters of water for 3 hours under a pressure of 4 atmospheres the solubility of the mineral constituents was increased to a considerable extent. Similar treatment acts like mercuric chlorid, chloroform, etc., in reducing the oxidizing or catalytic power of soils, which is ascribed to the action of oxydases (catalase) as well as bacteria. A device consisting of a Chamberland-Pasteur filter coated with gelatin rendered insoluble by the action of formaldehyde fumes for study of the osmotic power of soils is described, but no experiments with it are reported.

A study of rock decomposition under the action of water, A. S. CUSHMAN (*Chem. News, 93 (1906), No. 2410, pp. 50–53*).—This is a discussion of this subject based largely upon investigations which have already been noted (E. S. R., 17, p. 301).

Data are presented to show that electrical endosmosis offers an efficient means of separating not only water but also acids or alkalis from slimy, colloidal, and otherwise unfilterable mixtures such as are obtained with very fine rock powders. It is shown that by successive grindings and treatment with an electric current the potash can be removed from orthoclase and other minerals containing potash.

In the experiments reported "definite weights of the rock powders were slimed with a measured quantity of water, and the slime placed inside an ordinary unglazed porcelain cup such as is used for certain common types of bell batteries. An ordinary arc-light carbon was then inserted and the porcelain cup set down inside a glass cylindrical vessel containing distilled water to the depth of 2 or 3 cm. Another carbon electrode was then inserted in the outside compartment. The cell was then connected with a direct current of about 110 volts, the inner or slime chamber being in connection with the positive pole.

"Under the action of electrical endosmosis all the liquid from the anode or slime chamber passed into the cathode chamber, while at the same time, owing to electrolysis, the free alkali passed out in a condition in which it could be easily titrated or otherwise estimated. In the course of a few hours the slime had been transformed

into a hard, comparatively dry cake, while the free alkali had been partially removed. The alkaline liquor in the cathode chamber was then poured out into a beaker and titrated with tenth-normal acid. After resliming the material in the anode chamber with the proper quantity of water, the apparatus was started again. With the conditions under which we were working it was found that about one hour sufficed for each run."

The absorption of potassium by soils, O. SCHREINER and G. H. FAILYER (*Abs. in Science, n. ser., 23 (1906), No. 583, p. 324*).—This is an abstract of a paper presented at the New Orleans meeting of the American Association for the Advancement of Science.

The absorption of potash by soils was studied by the same methods used in case of phosphates and an equation representing the absorption is worked out, which is as follows: $\frac{dy}{dv}=K(A-y)$, in which K is a constant, A the maximum amount of potassium the soil can absorb under the conditions of the experiment, and y the amount it has absorbed when a volume v of potassium solution has passed through the soil. "The removal by water of the absorbed potassium is rapid at first, but the concentration of the percolates soon reaches a constant value, although only a fractional amount of the absorbed potassium has been removed. As far as the observations have been made the solutions obtained by percolating a solution of potassium chlorid through the soil have always been acid."

The absorption of phosphate by soils, O. SCHREINER and G. H. FAILYER (*Abs. in Science, n. ser., 23 (1906), No. 583, pp. 324, 325*).—This is an abstract of a paper presented at the New Orleans meeting of the American Association for the Advancement of Science. The subject was studied by percolating different phosphate solutions through soils of several types in an apparatus especially designed for the purpose and analyzing separate fractions of the solution which passed through. The absorption phenomena are represented graphically, and a differential equation, which is said to quite accurately describe them, is given. It was found that the absorptive capacity for phosphates varied greatly in different soils, being as a rule most pronounced in the clays and loams and less so in the sandy soils.

"The solubility of the phosphate originally present in the soils was also determined by percolating water through the untreated soils in the above-mentioned apparatus. It was found that the concentration of the separate fractions of percolate was practically a constant for each of the soils studied. If this concentration is reduced through any cause, such as the absorption by plants or influx of rain water, the original concentration will be again restored by more of the phosphate of the soil entering into solution. If, on the other hand, the solution is somewhat stronger than the natural concentration for that soil through any cause whatever, such as the application of a soluble phosphate, the concentration is reduced by absorption to the original strength. . . .

"This constancy in the strength of the soil solution, so far as phosphate is concerned, is further shown by the removal by water of the absorbed phosphate, which has been similarly investigated. It was found that the concentration of the separate percolates decreases rapidly until the concentration is reduced approximately to that of the original soil solution. This concentration of phosphate is then maintained with much persistence, although only a fractional amount of the absorbed phosphate has been removed, thus indicating that while the absorbed phosphate is apparently rendered insoluble, it is, nevertheless, slowly but constantly going into the soil moisture and is, therefore, available to plants."

The absorption of phosphates and potassium by soils, O. SCHREINER and G. H. FAILYER (*U. S. Dept. Agr., Bur. Soils Bul. 32, pp. 39, figs. 6*).—A briefer account of the investigations reported in detail in this bulletin has already been noted (see above).

The solubility of phosphoric acid in sugar-beet soils, J. STOKLASA (*Bl. Zuckerrübenbau, 13 (1906), Nos. 1, pp. 1-9; 2, pp. 17-25, pls. 2; abs. in Chem. Ztg., 30 (1906), No. 16, Repert. No. 4, pp. 55, 56*).—The importance of carbon dioxid produced by micro-organisms in the soil and given off by plant roots as a means of rendering the soil phosphates assimilable is discussed.

It is estimated that 1 gm. of a humus soil contains probably 20 to 30 million micro-organisms, which, with a 20 per cent water content and a temperature of 15° C., are capable of producing 50 to 60 mg. of carbon dioxid per day. The most rapid production of carbon dioxid occurs in the soil at the depth of 10 to 40 cm. and amounts during the growing period (150 days) to 112.5 metric centners per hectare (5,010.12 lbs. per acre).

The author's observations indicate that the fine roots and root hairs of sugar beets are capable of producing as much as 960 kg. of carbon dioxid per hectare in 60 days. The carbon dioxid dissolved in water exerts a direct solvent action on the phosphates of the soil.

On the improvement of a soil relatively deficient in magnesia, T. NAKAMURA (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 30-34*).—In pot experiments with a soil containing 17 times as much lime as magnesia it was found that although there was sufficient magnesia for the growth of barley plants, the addition of magnesia was very beneficial. The most favorable ratio of lime to magnesia was 7:1, provided the magnesia was applied in the form of sulphate.

"Since the best ratio of lime to magnesia for the growth of cereals was found to be 1:1 when magnesia was applied in the form of magnesite, it would have required 333 gm. magnesite per pot in order to attain the above ratio. As the best result was, however, obtained when 78.72 gm. magnesium sulphate were applied per pot, we may conclude that the relative value or agronomical equivalent of magnesium sulphate to magnesite is here nearly 23:100."

Meeting of the fertilizer section of the German Agricultural Society (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 7, pp. 69-74*).—Short accounts are given of the discussion of the following topics: The use of commercial fertilizers in Bavaria, preservation of barnyard manure and its most profitable use, and the influence of deficiency or excess of rainfall on the action of fertilizers.

Investigations by Pfeiffer at Breslau and Immendorff at Jena on the preservation of manures are summarized. The latter show that there is a considerable loss of nitrogen in the stall, and this is greater if the manure is allowed to lie for some time (say 7 days) under the feet of the animals than if it is removed daily. Contact with already fermenting manure apparently hastens the loss of nitrogen. The loss is greater both in the stall and in the heap in warm weather than in cold.

Kainit and superphosphate gypsum used at rates of 1.5 to 2 kg. per 1,000 kg. of live weight of animal were practically worthless. The use of sulphuric acid and superphosphate gypsum in amounts (3 kg. per 1,000 kg. live weight) giving a permanent acid reaction quite effectively prevented loss of nitrogen, but this is not practicable on account of excessive cost. The use of peat litter is the most effective means of preventing loss. In the experiments reported the loss of nitrogen was reduced to 7.3 per cent. The loss of nitrogen was less when the liquid manure was separated from the solid than when the two were mixed.

The sale of sheep manure, F. DE BARRAU (*Jour. Agr. Prat., n. ser., 11 (1906), No. 11, pp. 341-343*).—A brief note on local trade in this article and on its composition and fertilizing value. The following analysis is reported: Nitrogen (organic and ammoniacal) 1.36 per cent, phosphoric acid 0.26 per cent, potash 1.17 per cent, water 60.33 per cent. The manure is valued especially by viticulturists. Attention is called to the danger of impoverishing the farm by selling this material without returning an equal amount of fertilizing material in some other form.

Fertilizers on cereal crops grown in rotation, C. E. THORNE (*Ohio Sta. Circ. 54, pp. 15*).—This circular summarizes the results of 12 years' experiments on the station farm at Wooster, 11 years on the test farm at Strongsville, in northeastern Ohio, and 2 years each on the test farms at Germantown in southwestern Ohio and Carpenter in southeastern Ohio.

The crops grown at Wooster and Strongsville were a 5-year rotation of corn, oats, wheat, clover, and timothy; on the other farms a 3-year rotation of wheat and clover. The fertilizers used were phosphoric acid in form of acid phosphate alone and combined 2 by 2, and all 3 together with potash in form of potassium chlorid and nitrogen as nitrate of soda. Experiments at Wooster with barnyard manure untreated and treated with gypsum, floats, and acid phosphate are also briefly reported.

The results show that corn and oats responded profitably to moderate applications of phosphoric acid on the soils experimented with, which are believed to be typical of the soils of the State in general. The addition of potash to phosphoric acid in the fertilizer sometimes, but not always, gave a profitable increase in the yield of corn and oats.

The use of potassium seems to be especially indicated in regions where hay and straw, as well as grain, have been sold off the land for a considerable period, or where tobacco, cabbage, or other crops, in which the entire plant is taken off the farm, have been extensively grown.

"The complete fertilizer, containing nitrogen and potassium, as well as phosphorus, nearly always produced a larger total increase of corn and oats than any partial fertilizer; but when the nitrogen and potassium were purchased in commercial fertilizers their cost was usually greater than the additional gain, over that produced by phosphorus alone, was worth.

"The complete fertilizer invariably produced a larger increase in the wheat crop than that given by any partial fertilizer, and on the hard-run land at the main station, which has been exhaustively cropped with cereals for 60 to 75 years, the additional increase in the wheat and hay crops resulting from the use of the complete fertilizer more than offset its largely increased cost, leaving a larger net gain than that obtained from any partial fertilizer; but on land that had been resting in pasture for many years or on land in a high state of fertility the increase from the complete fertilizer has not yet been sufficient to justify its use, if the nitrogen and potassium must be purchased in commercial carriers; but in farm manure nitrogen and potassium may be secured practically without cost, and these experiments have shown that such manure may be made as effective a carrier of these elements of fertility as the most active forms in which they are found in commercial fertilizers." The barnyard manure treated with acid phosphate or floats was an especially effective fertilizer.

Inoculation of leguminous plants (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 11, pp. 641–659, figs. 3*).—This is an account of tests by 13 agricultural colleges and experiment stations in Great Britain of Hiltner's nitragin and Moore's inoculating material distributed by the Board of Agriculture. The general plan of the experiments include laboratory tests with sterilized soil or sand, pot cultures in unsterilized soils from various sources, and tests in accord with actual agricultural or horticultural practice, including inoculation of areas of field soil of various sizes.

"As a result of all the reported experiments, it seems evident that the cultures used were not uniform; it is not possible, however, to determine the extent to which the failures are to be attributed to this cause. It seems, however, from the positive results recorded that not only are these cultures sometimes able to produce nodules on the roots of plants new to a neighborhood, but that even in cases where the leguminous crop had been grown in the previous year benefit may be derived from inoculation.

"It is quite evident that the subject of plant inoculation in this country has not yet passed the experimental stage, and more work is required before one can feel at all justified in recommending either method for adoption on a field scale; nevertheless, the positive results obtained may lead farmers to hope that in the future benefit may be derived, in some instances at least, from the treatment of the soil or the seed before sowing, with inoculating materials preparatory to growing leguminous crops."

The fixation of atmospheric nitrogen (*Engineering [London], 81 (1906), No. 2090, pp. 89, 90; Sci. Amer. Sup., 61 (1906), No. 1573, pp. 25205–25207*).—This is a review of investigations on this subject, including in some detail the recent developments along this line in Norway and a list of references to the more important literature of the subject.

Fixation of atmospheric nitrogen, P. A. Guye (*Electricien, 1905, Dec. 30, Sup., p. 417; abs. in Rev. Sci. [Paris], 5. ser., 5 (1906), No. 12, pp. 376, 377*).—Investigations on this subject are briefly reviewed, and it is pointed out that the progress made toward the development of commercially successful methods must be based upon scientific investigations and theoretical considerations.

The fixation of atmospheric nitrogen (*Rev. Gén. Sci., 17 (1906), No. 6, p. 260*).—It is stated that the method of producing expanded arcs used by Birkeland and Eyde was first described by Plücker in 1861.[a]

On the utilization of atmospheric nitrogen, W. Löb (*Umschau, 10 (1906), No. 14, pp. 265–271, figs. 7*).—An illustrated account is given of the Birkeland and Eyde process as carried out at Notodden.

The manufacture of nitric acid at Notodden, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 10, pp. 296–299, figs. 4*).—The plant and methods used at this place for the preparation of nitric acid from atmospheric nitrogen by the Birkeland and Eyde process are described.

The factory at Notodden, Norway, for the manufacture of nitrate, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 11, pp. 328–330, figs. 2*).—Further descriptive details regarding the factory established at this point for the manufacture of nitrate from atmospheric nitrogen by the Birkeland and Eyde process.

The electric furnace of Birkeland and Eyde, L. Grandeau (*Jour. Agr. Prat., n. ser., 11 (1906), No. 9, pp. 265–268, figs. 3*).—The principles of construction of this furnace are explained and statistics are given as to the extent to which it is being used in Norway in the preparation of nitrogen compounds from the air.

Calcium cyanamid (*Mark Lane Express, 94 (1906), No. 3883, Fert. and Feed., p. 11*).—It is stated that the German Agricultural Society announces that it is now prepared to furnish this material, with 19 per cent nitrogen, in limited quantities for fertilizer tests at a cash price of about \$53.53 per ton, in bags f. o. b.

Nitrogen and nitrogenous fertilizers, P. G. Wicken (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 3, pp. 252–256*).—This article explains briefly the different forms in which nitrogen occurs and discusses the fertilizing value of the nitrogenous fertilizers available for use in West Australia, including nitrate of soda, nitrate of potash, ammonium sulphate, soot, blood manure, bone dust, tankage, guanos, urine and night soil, oil cake, wool waste, decomposed hair and lime from tanneries and fellmongeries, barnyard manure, and seaweed.

Production of nitrate, R. E. Mansfield (*Mo. Consular and Trade Rpts. [U. S.], 1906, No. 305, p. 53*).—The exports of nitrate from Chile to different countries during the year 1904 are given, the total being 740,869 tons, valued at \$52,847,132.

The use of ammoniacal gas liquor as a fertilizer, C. Dusserre (*Ann. Agr. Suisse, 6 (1905), No. 8, pp. 333–335; Bul. Mens. Off. Renseig. Agr. [Paris], 5 (1906), No. 2, pp. 183–185*).—Experiments with a liquor obtained from the gas works of Morges containing from 0.37 to 0.45 per cent of nitrogen, mostly in form of ammonia, but also containing small amounts of sulphid, cyanid, sulphocyanid, etc., are reported.

[a] Ann. Phys. [Poggendorff], 113, p. 252.

The material was applied to grass lands in connection with superphosphate, 500 kg. per hectare (445 lbs. per acre), and potash salts, 300 kg. per hectare (267 lbs. per acre) at rates of 5,000 to 15,000 liters per hectare (about 3,300 to 9,900 gal. per acre) on March 20 and June 8, before and after the first cutting of grass. The smaller application produced very little increase in yield. The larger application produced sufficient increase in yield to pay the cost of transportation and distribution. The addition of sulphate of iron, 500 kg. per hectare (445 lbs. per acre) further increased the yield and completely destroyed mosses in the grass. The use of the gas liquor resulted in the disappearance of leguminous plants from the herbage, but favored the development of the graminæ. The first application of the liquor burned the grass more or less, but it promptly recovered from this injury.

The general conclusion reached was that farmers in the vicinity of gas works may use this material with advantage if they can secure it free of cost. It may be applied with advantage during the winter on grass lands or on uncultivated land either directly or in mixture with liquid manure. Since it contains only nitrogen, it should be supplemented with phosphatic, potassic, and calcareous fertilizers. If applied directly during the summer it may seriously injure plants, but it may be safely used in mixtures with soil or compost.

Bone products, J. C. McNally (*Mo. Consular and Trade Rpts., 1906, No. 305, p. 155*).—A brief note is here given on the composition and fertilizing value of raw and degelatinized bone meal and precipitated bone phosphate. The use and value of the precipitated phosphate as a feeding stuff is also referred to.

Phosphate rock production, E. O. Hovey (*Amer. Fert., 24 (1906), No. 3, p. 21*).—Statements from advance reports of the U. S. Geological Survey are cited showing that the marketed production in 1905 probably exceeded 600,000 long tons as against 530,571 tons in 1904. There was a marked increase in production in Florida and Tennessee and a smaller increase in South Carolina. The average price of phosphate was higher in 1906 than in 1905 due to increased demand in Europe.

Potash as a fertilizer, P. G. Wicken (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 5, pp. 422–424*).—A concise summary is here given of the principal facts relating to this subject.

Analyses of commercial fertilizers, M. A. Scovell et al. (*Kentucky Sta. Bul. 121, pp. 83–153*).—Analyses and valuation of 421 samples of fertilizers inspected during the spring of 1905 are reported.

Analyses of fertilizers, C. A. Goessmann (*Massachusetts Sta. Bul. 107, pp. 42*).—This bulletin gives market values of fertilizing ingredients and reports analyses of licensed fertilizers collected in the general market and miscellaneous fertilizing materials sent to the station for examination, including wood ashes, lime ashes, cob ashes, cotton-seed meal, Peruvian guano, meat and bone, tankage, factory waste, kiln-dried pulverized sheep manure, sheep manure, soils, muck, and complete fertilizers.

Analyses of fertilizers and insecticides, C. A. Goessmann (*Massachusetts Sta. Bul. 109, pp. 28*).—This bulletin includes notes on the taking of samples for analysis, instructions to manufacturers and dealers in commercial fertilizers, a discussion of trade values of fertilizing materials for 1906, and analyses of miscellaneous fertilizing and insecticide materials.

The list includes wood ashes, cotton-hull ashes, lime ashes, refuse ashes, nitrate of soda, cotton-seed meal, new process linseed meal, dried blood, high grade sulphate of potash, carbonate of potash, muriate of potash, double manure salts, kainit, dissolved boneblack, superphosphate, dissolved bone, ground bone, tankage, dry ground fish, carbonate of lime, prepared lime, cotton waste, cotton-seed compost, rotted cotton waste, damaged cocoa, glue refuse, leather dust, bone soup, refuse from wool washings, factory refuse, muck, peat, mud from the decomposition of seaweed, granulated tobacco stems, Peruvian guano, pigeon manure, complete fertilizers, soils, Paris green, arsenate of lead, and other insecticides.

Analyses of commercial fertilizers, P. SCHWEITZER and R. M. BIRD (*Missouri Sta. Bul. 66, pp. 8*).—This bulletin contains a report of analyses of commercial fertilizers collected during the fall of 1904 and the spring of 1905, as well as a financial statement of the receipts and disbursements of the fertilizer control fund for the year ended December 31, 1904.

Analyses of commercial fertilizers, P. SCHWEITZER and R. M. BIRD (*Missouri Sta. Bul. 70, pp. 11*).—This bulletin reports analyses of commercial fertilizers collected during the fall of 1905, and gives a statement of receipts and disbursements of the fertilizer control fund for the year ended December 31, 1905.

Commercial fertilizers, W. W. MILLER and N. W. LORD (*Offic. Rpt. Sec. Ohio Bd. Agr. on Com. Ferts., 1905, pp. 100*).—The results of inspection of fertilizers in Ohio during the year 1905 are given, with statements regarding the fertilizer control and the valuation of fertilizers, and the text of the State fertilizer law.

Licensed commercial fertilizers, 1906, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Bul. 134, pp. 1-17, 24-26*).—Analyses of 22 brands of fertilizers licensed for sale in Wisconsin during 1906 are reported, with a brief general discussion on the purchase, valuation, and use of commercial fertilizers, and the text of the State fertilizer law.

Fertilizers in Japan (*Bd. Trade Jour. [Gt. Brit.], 1906, Jan. 4; abs. in Jour. Soc. Chem. Indus., 25 (1906), No. 2, p. 84*).—Statistics are given showing the extent and increase of use of fertilizers in Japan, especially of oil cakes.

The value of the fertilizers imported into Japan during the first 6 months of 1905 is reported to have been 12,976,352 yen ($6,462,223.30). Of this amount 7,265,109 yen ($3,618,024.28) was paid for oil cake, 638,217 yen ($317,832.07) for ammonium sulphate, 1,179,304 yen ($587,293.39) for calcium phosphate, and 636,997 yen ($317,224.51) for sodium nitrate. The oil cake comes from China, one-third of the nitrate from the United States, and the remainder from Chile and various other countries, the calcium phosphate and ammonium sulphate from the United Kingdom. There are several chemical factories at Osaka which produce fertilizers, especially ammonium sulphate.

Artificial fertilizers, P. G. WICKEN (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 1, pp. 7-18*).—This article discusses especially the prices and value of the fertilizing materials available in West Australia, and gives formulas for fertilizer mixtures for various kinds of crops, with directions for their application. The draft of various crops on the fertilizer constituents of the soil is also explained.

AGRICULTURAL BOTANY.

Plant breeding, L. H. BAILEY (*New York and London: The Macmillan Co., 1906, pp. XIV+483, figs. 48*).—This is a fourth edition of the author's work on plant breeding, which first appeared in 1895 (E. S. R., 7, p. 562).

The most marked changes in this work are to be found in chapter IV, which has been wholly rewritten and which gives a résumé of the investigations of de Vries, Mendel, and others, and in chapter V, which gives accounts of current plant-breeding practice. This last chapter summarizes the work of Burbank and Keeney, and the investigations of the experiment stations and of this Department along this line. A chronological bibliography of references to such literature as English-speaking horticulturists would be most likely to find completes the volume. The bibliography embraces something over 100 pages and is brought down to 1905.

On the correlation between calcium salts and the assimilation of nitrate nitrogen, V. V. YERMAKOV (*Zhur. Opuitn. Agron. (Russ. Jour. Expt. Landw.), 6 (1905), No. 4, pp. 403-431*).—The formation of ammonia and oxalic acid when nitric acid acts on glucose suggested to the author the possibility of a similar reaction taking place in plants during the assimilation of nitrate nitrogen, whereby the ammonia

serves for the synthesis of albumin and the oxalic acid, precipitated by the calcium, remains without further influence. If this hypothesis were true, in the absence of calcium salts the oxalic acid formed would not be neutralized, and, being injurious to plants even in small quantities, would hinder the assimilation of the nitrate nitrogen.

To determine this subject the author carried out 3 series of experiments with leaves of grapes, *Paulownia imperialis*, and *Ailanthus glandulosa*. In these experiments the author used one side of the leaves of grapes and Paulownia and the leaflets on one side of the rachis of Ailanthus, the other portions remaining as a check. The nitrate nitrogen was determined by the Schultze-Tiemann method.

In the first series of experiments some of the leaves were placed for 24 hours in a 0.2 per cent solution of calcium nitrate and others in a 0.2 per cent solution of potassium nitrate. At the end of the experiments only traces of nitrate nitrogen were found in the leaves receiving the calcium solution, while the leaves placed in the potassium solution contained an appreciable quantity of nitrate nitrogen. This seems to indicate that in the leaves receiving calcium the nitrate was consumed by the plant.

In the second series of experiments the leaves were placed in a 0.2 per cent solution of potassium nitrate and were then cut in halves, some of which were used as controls while others were placed in various solutions. The results show that in the leaves which had received calcium salts the nitrate disappeared, being assimilated, while where no calcium salt was present the nitrate remained unaffected. The author concludes from this that calcium is indispensable for the assimilation of nitrate nitrogen.—P. FIREMAN.

The morphology and biology of nitrogen-assimilating organisms, L. LUTZ (*Les microorganismes fixateurs d'azote. Paris: J. Lechevalier, 1904, pp. 187, figs. 19; abs. in Centbl. Bakt.* [*etc.*], *2. Abt., 15* (*1905*), *No. 15-16, pp. 477, 478*).—The author gives a critical review of the literature relating to nitrogen assimilation by bacteria and other micro-organisms and practically gives a summary of the present status of knowledge on the morphology and biology of nitrogen-assimilating organisms.

After a historical résumé, the author gives an account of the attempts to cultivate the nitrogen-fixing organisms, particularly the experiments of Winogradski and Beijerinck, and of the cultures known as Alinit. The general conditions for fixation of nitrogen in the soil and factors limiting it are described, after which especial attention is given the morphology and physiology of the tubercles on the roots of the Leguminosæ and of the organisms which they contain. The literature on the culture of these organisms is reviewed at considerable length, and suggestions are given for the growth of the bacteria in nitrogen-containing and nitrogen-free media. The biological forms and physiological characteristics of the organisms are described and the various factors controlling nitrogen assimilation are reviewed. Accounts are given of various attempts in the utilization of the bacteria by applying them to practical use in the field, particularly on the use of pure cultures.

In addition to the Leguminosæ the author shows that tubercles of a similar nature occur on the roots of alders, Eleagnus, Podocarpus, Myrica, Datisca, etc.

A chapter is devoted to the fixation of free atmospheric nitrogen through symbiosis between algæ and bacteria by mosses, etc.

An extended bibliography of literature completes the volume, about 500 titles being cited.

Effect of differences in solar radiations on the transfer of albuminoids in wheat, J. DUMONT (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 18, pp. 686-688*).—It having been claimed that light is necessary for the formation of albuminoids in plants and that the more refrangible rays are most active in this respect, the author investigated the subject and reports experiments carried on during 2 different

seasons to test the effect of blue, black, red, and green colored screens on the production of grain and chaff of wheat.

In 1904 the wheat grown under the black screen was richest in nitrogen, followed by the specimens grown under green, blue, and red screens. In 1905 the experiments were repeated, and in this case the highest amount of nitrogen was found in the plants grown under the green screens, followed by those under the black, blue, and red.

Incidentally the effect of these different colored screens on germination was tested, and out of 100 grains selected, 92 germinated in the check, 94 under the black, 97 under the red, and 99 under the blue and green screens.

Anatomical and physiological changes produced in tropical plants by change of environment, D. BOIS and I. GALLAUD (*Compt. Rend. Acad. Sci.* [*Paris*], *141* (*1905*), *No. 24, pp. 1033-1035*).—Attention is called to the marked physiological and anatomical changes which take place in various economic tropical plants when taken from one region to another, and the failure to secure the successful economic introduction of many plants, such as rubber, fiber plants, etc., is attributed to these changes.

Wound stimuli, parasitism, and gum flow of the Amygdalaceæ, M. W. BEIJERINCK and A. RANT (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *15* (*1905*), *No. 12, pp. 366-375*).—On account of the frequent occurrence of gum flow associated with certain diseases of species of Prunus, the authors have investigated the theories of the effect of wound stimuli to gum flow and the relation of parasites to wound stimuli.

The principal experiments were made with young shoots of the peach and of a reputed hybrid between the peach and almond. The effect of wounding the cambium in both young and old twigs is shown and comparisons are made with the stimulus caused by poisons, heat, etc. The influence of species of fungi in inducing wound stimuli is described, and gum flow is reported as associated with a considerable number of species. In conclusion comparisons are drawn between this form of gum secretion and the resins and gums produced by other plants.

Some experiments in the control of color in plants, H. KRAEMER (*Abs. in Science, n. ser.*, *23* (*1906*), *No. 585, pp. 423, 424*).—In a previous publication (E. S. R., 16, p. 540) the author shows that the unorganized or cell-sap color substances in plants readily react with various chemicals, producing in many instances marked changes in color. It was found that the majority of plant-color substances turned green when under the influence of calcium hydrate, deep red with organic acids, rich purple with potassium and aluminum sulphate, and blue with iron sulphate.

In 1904 the author carried on a series of experiments in this Department for the purpose of determining the effects of certain chemicals on the color principles of plants, the material studied being carnations, roses, and pansies, which were grown in the presence of a large number of chemicals. The results published are considered only preliminary, but it was found that in the case of La France roses the petals became of a uniform pink color when the plants were supplied with iron citrate and citric acid. Maroon roses became dark red when the plants were supplied with phosphoric acid, iron and ammonium sulphate, or sulphuric acid. The maroon roses when treated with sulphuric acid were found to take on a crimson color and they also tended to produce single flowers.

Some factors concerned in color production in a species of Fusarium, J. B. POLLOCK (*Abs. in Science, n. ser.*, *23* (*1906*), *No. 585, pp. 422, 423*).—A series of experiments was carried on with species of Fusarium obtained from the cut ends of corn stubble.

One of the characteristics of the fungus is the bright salmon-pink color which develops on many artificial media under proper conditions. Among the conditions necessary for its development are direct sunlight, in the absence of which only a pale cream color is produced, generally without a tinge of red. Moisture is also an impor-

tant factor in the development of color, and various media were found to influence the color produced by the fungus in a marked degree.

The induction of new species, D. T. MacDougal (*Abs. in Science, n. ser., 23 (1906), No. 585, p. 422*).—The effect of some chemical agents on the development of new species is briefly described in an account of experiments in which the ovaries of Raimannia were stimulated immediately previous to fertilization.

Among the seeds secured were a number which produced plants differing from the normal or typical species, and the series of experiments seems to demonstrate that factors external to the protoplast may exert a profound influence upon the hereditary characters, developing qualities not hitherto exhibited in the parent plants.

FIELD CROPS.

Report of the agriculturist, B. C. Buffum (*Colorado Sta. Rpt. 1901, pp. 20–31, pl. 1*).—A brief report of the work of the agriculturist during the season of 1901 is given. Several varieties of wheat grown for a number of years at altitudes of 7,000 ft. showed a remarkable deterioration when planted at the station. In a field experiment with potatoes, untreated selected clean seed gave the largest yield. The shrinkage of 8 lots of potatoes during 4½ months ranged from 5.2 to 8.5 per cent. Notes are given on a number of varieties of macaroni wheats tested in 1901.

The results obtained with Hanna barley indicated that the variety is well adapted to Colorado conditions. Black oats from Colorado seed gave 71 bu. per acre, North Finnish 60.5 bu., and Silesian 52.4 bu. Three acres of Russian spelt, sown at the rate of 100 lbs. per acre, yielded 181 bu., machine measure. The crop weighed 5,386 lbs., or about 30 lbs. per bushel.

A report of the cooperative grass and forage plants experiments with the U. S. Department of Agriculture at the Colorado Agricultural Experiment Station in 1901, A. H. Danielson (*Colorado Sta. Rpt. 1901, pp. 32–38, pls. 4, dgm. 1*).—The grass garden of the station is described and the species making a good growth, a moderate growth, little growth, or dying out after coming up, and those not germinating are listed and the more important and successful ones briefly noted. The grasses and forage plants under field culture are also briefly discussed.

Succotash as a soiling crop, R. S. Shaw (*Michigan Sta. Bul. 235, pp. 113–127, figs. 4*).—The advantages and disadvantages of several crop mixtures grown for forage from 1903 to 1904, inclusive, are pointed out and notes on their culture and uses are given.

On May 8, 1903, a mixture of 1 pk. of corn, 1 pk. of peas, 1 pk. of oats, and 6 qts. of barley was drilled at the rate of 2½ bu. per acre. The cutting and feeding of this crop to pigs was begun June 24 and lasted 12 days. The yield was at the rate of 22,887 lbs. of green crop per acre. Owing to abundant rainfall, the growth was exceedingly dense and tall. The objection to this mixture was that it did not contain plants making a second growth after cutting.

In 1904 corn, peas, oats, rape, and millet were sown May 7 on two different plats. Pigs were turned in one plat on June 20 and kept there for 32 days. The second growth of rape and millet in this mixture was good.

In 1905 corn, oats, peas, rape, and clover were sown May 1 on one plat and May 20 on another. Floods interfered with the crop, but the data secured from the early sowing showed a yield of green forage of 12.16 tons per acre. Samples taken from 4 representative areas each 2 ft. square showed that these 16 sq. ft. had produced the following number of plants: Oats, 61; peas, 68; rape, 55, and corn 22, their weights being 10.6, 4.2, 2.75, and 0.5 lbs., respectively. The second sowing yielded at the rate of 12.62 tons of green forage per acre and the 4 representative areas, including 16 sq. ft., in this case contained the following number of plants: Corn, 74; peas, 82; oats, 43, and rape 10, the respective weights being 6.9, 1.7, 4.3, and 0.3 lbs. The cutting of this sowing began July 22 and was completed August 11. The composition of samples taken in 1904 and 1905 is recorded.

[Experiments at the agricultural experiment station at Vienna, 1905], O. Reitmair (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 3, pp. 148–179*).—The work of the department of agronomy is reviewed and the results secured are briefly reported.

The average results of several fertilizer tests with potatoes, sugar beets, winter rye, and winter wheat show that of the total increase in yield secured from the complete application the following percentages were due to the use of nitrate of soda: Potatoes 48.7, sugar beets 38.2, winter rye 57.5, and winter wheat 40 per cent. The hoed crops received 200 kg. of nitrate per hectare and the cereals 150 kg. These comparatively small applications are regarded in general as the most profitable for the soils under test.

Potash was applied in the form of kainit and potash salt in quantities furnishing 100 kg. of potash per hectare, and the effect of this single application observed for 3 years. The first year the increase in the different crops due to potash was medium and regular, but where kainit was applied to oats no increase was secured. The second year the effect of potash on all crops excepting clover was weak, being weakest with oats. The third year the residual effect was still quite noticeable with clover, where the potash salt showed a better growth than the kainit, while the year before the kainit produced the better crop. The potash requirements of barley did not seem greater than those of other cereals.

Fertilizer experiments on meadows and inoculation experiments with different leguminous plants, together with other work of the station are also reviewed.

Fertilizer experiments on meadows, A. Grete (*Landw. Jahrb. Schweiz, 20 (1906), No. 2, pp. 117–148*).—The results of cooperative experiments carried on from 1898 to 1900, inclusive, are reported. The plats, each containing 100 square meters, were given various combinations of phosphoric acid, potash, nitrogen, and lime at the rate of 0.8, 1, 0.45, and 2 kg. per plat, respectively. Lime was applied only in 1898.

It was found that the soil was very much in need of phosphoric acid while its potash requirement was small, the yields with phosphoric acid alone being almost as large as where the 2 elements were given together. Nitrogen gave a small increase in the yield of dry matter, but the production of protein was smaller than without it. The increase in dry matter was insufficient to pay for its use. Phosphoric acid and potash favored the growth of clovers and proved most profitable, although the potash added comparatively little to the increase in yield.

Some suggestions relative to alfalfa growing in Ohio, C. G. Williams (*Ohio Sta. Circ. 49, pp. 3*).—Brief general directions for alfalfa culture are given.

The station found that on soil derived from sandstone the use of a ton of lime per acre was much more effective than other kinds of treatment, while on a limestone soil the application of lime gave no beneficial results. In some plat experiments on a limestone soil the use of 200 lbs. of steamed bone per acre seemed to have increased the yield over 148 per cent, while an application of 8 tons of stable manure per acre apparently gave an increase of 210 per cent.

Alfalfa seed: Its adulterants, substitutes, and impurities and their detection, H. F. Roberts and G. F. Freeman (*Kansas Sta. Bul. 133, pp. 51–111, figs. 44*).—The impurities commonly occurring in alfalfa seed are enumerated and described, and the results of purity and germination tests made by the station are recorded.

Seed of yellow trefoil (*Medicago lupulina*) was found to be the chief adulterant, but in a number of samples bur clover (*M. denticulata*) and sweet clover (*Melilotus alba*) also occurred. It is pointed out that the seeds of these 3 species, unless present in large quantities, can not be readily distinguished from the seeds of alfalfa. Yellow trefoil and bur clover injure the quality of the forage produced, and on account of their being annuals die out after the first year and thus reduce the stand. Sweet clover is a biennial, and is generally distasteful to stock.

The chief impurity in western alfalfa seed is the dead seed of the alfalfa itself, and the obnoxious weed seeds most commonly present were chiefly those of species of docks and English plantain (*Plantago lanceolata*).

The range of germination in the samples ran from 60 to 96 per cent, with an average of about 83 per cent. The separation of dead alfalfa seed was not found practically possible, and it is recommended that the grading of alfalfa seed be based upon actual germination tests.

Correction of a very unfavorable ratio of lime to magnesia in a soil for the culture of barley, G. Daikuhara (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 13-16, pl. 1*).—The soil originally contained 0.64 per cent. of calcium oxid and 1.91 per cent of magnesium oxid, representing a ratio of 0.34 : 1. By adding sufficient lime to make the ratio of these two substances 1 : 1 the yield of barley was doubled on well-manured soil, and even more than doubled when the manuring was one-sided or when no application at all was made. This result is attributed not only to the regulation of the ratio of lime to magnesia, but also to the improvement of the physical and chemical condition of the soil resulting from raising the lime content.

Buckwheat, J. L. Stone (*New York Cornell Sta. Bul. 238, pp. 179-193, figs. 5*).—This bulletin gives a general account of the buckwheat plant, with directions for its culture and uses.

An experiment was made by the station in 1901 to determine whether better results could be secured by turning rye under early in the season or by allowing it to grow until shortly before drilling in buckwheat. The results indicated that early plowing and subsequent harrowing to produce a thorough settling of the soil gives the better results. It is recommended that if early plowing is impracticable greater attention should be given to a thorough fitting of the seed bed.

The average yields in a variety test were as follows: Japanese 27.5 bu., Common Gray 26.8 bu., and Silver Hull 19.5 bu. per acre. In cooperative tests by 14 farmers in various parts of the State the average yield of Japanese was 21.29 bu. per acre and that of Silver Hull 20.05 bu.

Buckwheat, E. Haselhoff (*Landw. Vers. Stat., 63 (1906), No. 5-6, pp. 375-406, figs. 11*).—A general description of the buckwheat plant, directions for its culture, a review of experiments conducted with the crop, and a discussion of the chemical composition of the grain, straw, and mill products, together with their feeding value, are given. A bibliography of 17 references is listed.

The cassava industry, L. Colson and L. Chatel (*Culture et industrie du manioc. Paris: A. Challamel, 1906, pp. 95, figs. 7, map 1, dgm. 1*).—This book treats of the culture of cassava on the Island of Réunion, and gives a résumé of the different operations necessary in the manufacture of starch and tapioca. Estimates are given on the cost of production of the crop and the manufactured food materials.

Adulteration of red clover seed, J. Wilson (*U. S. Dept. Agr., Office Sec. Circ. 18, p. 1*).—Of 521 samples of seed of red clover obtained in the open market 116 contained dodder and 5 were found to be adulterated with seed of yellow trefoil. These samples contained from 18.29 to 52.64 per cent of yellow trefoil.

Corn, W. H. Scherffius (*Kentucky Sta. Bul. 122, pp. 155-189, pls. 3*).—A method of selecting seed corn is outlined and a chemical study of the composition of a number of varieties of Kentucky corn is reported. Each variety is described and the results of analyses are given in tables.

These results show that the percentage of nitrogen does not differ materially in the individual whorls of grain on the ear, beginning at the butt, until after the middle is passed, when there is a gradual falling off in the nitrogen content toward the tip. In some instances, however, the grains at the tip contained a higher percentage of nitrogen than the grains in any part of the ear, while in other cases they contained the lowest.

In 3 samples of yellow corn with white-tipped grains scattered about over the ears, possibly due to cross fertilization, there was no material difference in the percentage of nitrogen of the white tipped and the yellow grains. The author concludes that this indicates that there is no change in the nitrogen content from the first year's cross fertilization. Longitudinal rows of grains on opposite sides of the ears gave approximately the same percentage of nitrogen.

Experiments with corn, C. G. WILLIAMS (*Ohio Sta. Circ. 53, pp. 11, dgms. 2*).—The tabulated results of varieties of corn tested for 3 years show that many of them are not adapted to Ohio conditions. Experiments in thick and thin seeding pointed out that the increase in yield was very pronounced up to an average stand of 3.62 plants per hill, the rows being 42 in. apart each way, but that it was accompanied by a decline in average weight per ear, which was especially marked when more than 3 plants were grown per hill.

From field counts made in 63 counties by 328 correspondents it was estimated that the stand of corn in the State for 1905 was 83.6 per cent. The method of conducting an ear-row test plat is described in detail and the total yields of each row of a duplicate test of this kind is shown in a diagram. The yields from the different ears varied from 50 to 115 bu. per acre. Notes are given on a score card for dent corn and on the selection of seed ears.

Cooperative fertilizer experiments with cotton in 1901, 1902, 1903, and 1904, J. F. DUGGAR (*Alabama College Sta. Bul. 131, pp. 17-74*).—In these cooperative experiments the station furnished material and instruction to farmers upon the agreement that the tests be made. The first year 10 reports were received, the second 13, the third 10, and the fourth 21. The conclusions and suggestions are based on these experiments and on earlier work.

The use of acid phosphate was found almost universally beneficial. Kainit, which was less frequently of benefit than acid phosphate, gave its best results where the crop was attacked by black rust. One hundred pounds of this substance per acre was usually found sufficient. The results indicated that on soils containing much clay kainit was unprofitable.

Cotton-seed meal proved to be very effective on all soils except on new land, or on soil rich in vegetable matter. For old lands a mixture of acid phosphate and cotton-seed meal, or of these two substances and kainit, is recommended. A small growth of stalks under favorable conditions of climate and culture is regarded as showing a deficiency of nitrogen in the soil, and a rank growth as indicating that only a small quantity or no nitrogen at all need be applied. The use of phosphates hastened maturity and the freshness of the land reduced the need for nitrogen. After a luxuriant growth of cowpeas or a recent heavy dressing with stable manure or cotton seed, applications of cotton-seed meal were superfluous. Fertilizer formulas for the cotton crop on various kinds of soils in different parts of Alabama are suggested.

The great millet or sorghum in Madras, C. BENSON and C. K. SUBBA RAO (*Dept. Agr. Madras Bul. 55, pp. 122*).—This bulletin gives a popular description of the crop and of the methods of its culture in Madras.

Four-year culture tests with oats, 1901-1904, W. EDLER (*Arb. Deut. Landw. Gesell., 1906, No. 114, pp. 370*).—The individual tests of cooperative experiments for the different years are described and notes are given on the 13 varieties compared. Strube oats gave in general the highest yields of grain, and especially good returns were secured under favorable moisture conditions.

In dry seasons Leutewitz Yellow ranked first in yield of grain, but in seasons with a greater moisture supply several varieties gave better yields. Beseler II succeeded only with a good supply of soil moisture, while Beseler III gave average results for the different years as compared with all the varieties tested. Duppau, Heine Prolific, Heine Trauben, and Anderbeck gave medium yields and were apparently not very readily influenced by weather conditions. Probstei and Fichtelgebirg produced medium yields under unfavorable conditions, but otherwise they were out

ranked in productiveness by a number of sorts. Beseler I gave the lowest yield of grain, but with Strube ranked first in all years in straw production. Anderbeck and Selchow side oats were also heavy yielders of straw, while Selchow Panicle, Fichtelgebirg, Probstei, and Beseler III stood last in this regard.

A high percentage of grain was produced by Selchow Panicle, Beseler III, Duppau, Leutewitz Yellow, Probstei, and Beseler II, and a low percentage by Selchow side oats and Beseler I. Beseler II, Strube, Anderbeck, Probstei, and Duppau produced the heaviest grain, and Heine Trauben, Fichtelgebirg, Selchow side oats, and especially Leutewitz Yellow, the lightest. The liter weight of the grain varied considerably in different years and was quite irregular. Leutewitz Yellow and Beseler III were lowest in percentage of hull and Beseler II, Strube, and Fichtelgebirg highest.

The grain of Beseler I, Selchow side oats, Anderbeck, and Beseler II was richest in protein, while that of Fichtelgebirg and Leutewitz Yellow was poorest. Selchow side oats and Leutewitz Yellow outranked all other varieties in the fat content of the grain, and Leutewitz Yellow also ranked first in ash content. On the average, Fichtelgebirg ripened earliest, but showed the greatest tendency to lodge. Duppau, Strube, and Heine Prolific stood up well, and Selchow Panicle apparently produced the strongest straw. The Beseler varieties, together with Leutewitz Yellow, Heine Trauben, and Strube, proved quite smut-resistant.

The strong stooling varieties were Fichtelgebirg and Leutewitz Yellow, and the weak stooling sorts Strube, the Beseler varieties, Heine Prolific, and Selchow Panicle. The Beseler varieties produced the longest straw, and Fichtelgebirg, Strube, and Leutewitz Yellow the shortest. Anderbeck, the Beseler oats, and Strube were characterized in comparison with the other varieties by thick stems.

A preliminary report on growing Irish potatoes, C. M. CONNER (*Florida Sta. Bul. 82, pp. 387-406, pls. 4*).—A brief discussion of potato culture in Florida is given and the results of experiments in 1905 are tabulated but no conclusions are drawn from the data. The work consisted mainly of fertilizer tests to determine the best sources and the best quantities of the essential plant food elements.

Of different varieties tested Rose No. 4, grown from blossom ends, yielded 215 bu. and grown from stem ends, 225 bu. of marketable potatoes per acre. These were the heaviest yields secured. This same variety grown from Massachusetts seed yielded 160 bu., from Virginia second-crop seed 179 bu., and from seed grown at the station during the previous fall from small potatoes left from the spring crop, 89 bu. per acre.

Some results of potato investigations in 1905, T. C. JOHNSON ([*Quart.*] *Rpt. W. Va. Bd. Agr., 1 (1906), pp. 41-50*).—Potato culture as carried on in West Virginia in the counties bordering on the Ohio River is described with reference to its extent on the bottom lands along the river, the fertilizer applications and crop rotation, the soil and its preparation, planting and cultivating the crop, harvesting and marketing, and the attacks of fungus diseases.

The principal varieties grown are Early Ohio, Carmen No. 1, Carmen No. 2, Green Mountain, and Sir Walter Raleigh. Experiments in spraying with Bordeaux mixture indicated that this was a profitable operation, a marked gain being shown in the production of the highest grade of tubers. With reference to that part of the crop consisting of small tubers spraying was unprofitable.

A rough skin in its relation to the starch content of potatoes, R. KRZYMOWSKI (*Jour. Landw., 54 (1906), No. 1, pp. 57-64*).—Work on this subject by different investigators is reviewed and the author's own results are presented. The rough and smooth skinned tubers of 15 different varieties were analyzed and in 14 cases the rough-skinned tubers were richer in starch. The starch content of the smooth-skinned potatoes ranged from 16 to 19.2 per cent and that of the rough from 17.1 to 21.6 per cent.

On the application of magnesia in the form of magnesium sulphate for the needs of the rice plant, G. DAIKUHARA (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1*

(1905), No. 1, pp. 23-29, pl. 1).—The results of pot experiments are reported which "show that in the presence of lime as carbonate the necessary amount of magnesia, when applied as crystallized sulphate for paddy rice in sand culture, is so small that the best ratio CaO : MgO becomes 30:1, while in the form of natural carbonates the best ratio would be 1:1 as Aso [E. S. R., 15, p. 1062] had ascertained. This conclusion will hold good also for various sandy soils, while for clayey soils the best ratio $\frac{\text{CaO as carbonate}}{\text{MgO as sulphate}}$ will differ."

Additional experiments, making comparative tests of sodium nitrate and ammonium sulphate, showed that the application of nitrogen as sodium nitrate was not favorable to rice plants, its relative value as compared with ammoniacal nitrogen being as 40 to 100.

The anatomical structure of the stems of spring rye grown on moor soils and its change under the influence of manurial treatment, P. VAGELER (*Jour. Landw., 54 (1906), No. 1, pp. 1-30*).—The thickness of the stem wall was found to decrease from the base toward the top of the stem. All parts of the stem not protected by the leaf sheaths showed an evenly developed cuticle, but the epithelium was much strengthened in the upper parts of the stem and in the internodes.

At the lower joints of the internodes the stomata under the leaf sheaths remained inactive and there was practically no development of chlorophyll. The hypoderma was found strongest in the lower parts of the stems and in the internodes. The development of the parenchyma was greatest in the lower portions of the stem and in the upper parts of the internodes. The tissue through which protein is translocated prevailed near the head. The proportion of lumina to cell walls in the stem increased from below toward the spike, corresponding to the lesser strength requirements in the upper portions near the head.

The results of experiments to determine the influence of the fertilizer applications used showed that all manurial treatment, excepting the use of phosphoric acid by itself, tended to increase the size of the stem by enlarging the cell lumina at the expense of the cell walls. The parenchymatic tissue also increased with the quantity of fertilizer applied. Potash, without weakening the stem, favored the production of parenchyma and assimilative tissue and a reduction of unproductive tissue. Its use also resulted in a marked strengthening of the cuticle.

Nitrogen remained indifferent toward the length of the stem and the development of the fibro-vascular bundles, but it reduced the quantity of hypoderma, especially in the lower internodes. This result, coupled with a greater production of chlorophyll in the lower parts of the plant and a reduction in percentage of cell wall, weakens the stem. When nitrogen and potash were applied together the effect of weakening the cell wall was quite marked. Phosphoric acid given in excess produced exceptionally low yields. While acting favorably on the development of the framework of the plant, phosphoric acid reduced the total quantity of cell wall, but when applied with potash and nitrogen it had a strengthening effect on the plant.

Experiments with sugar beet, G. CLARKE (*Essex Ed. Com., County Tech. Labs., Chelmsford, 1906, Jan., pp. 22, pl. 1, figs. 3*).—Experiments were conducted at 5 different points. The average yield of sugar beets per acre was 18.3 tons, the percentage of sugar in the beet 16.7, and the purity 84.7. The results with Redtop sugar beet were not included in the average figures just given. This variety gave an average yield of 24.5 tons per acre, with 11.8 per cent of sugar and 79.2 purity.

Seedling canes and manurial experiments at Barbados, 1903-1905, J. P. D'ALBUQUERQUE and J. R. BOVELL (*Imp. Dept. Agr. West Indies, Pamphlet 40, 1906, pp. 119*).—A summary of part of the work with sugar cane carried on under the direction of the Imperial Department of Agriculture is given.

The varieties of canes were grown on black soils in 12 cases and on red soils in 3. Cane B. 208 again gave good results as plant canes, especially on red soils. B. 147

outranked all the other varieties tested on the black soils. Of the newer varieties B. 1,529 stood second on both black and red soils. The results indicated that the application of nitrogen both to plants and rattoons is profitable. Sulphate of potash was also profitable, but phosphatic fertilizers either had no effect or decreased the yield.

Report on experiments with varieties of swedes, 1902–1905, W. ALLAN (*Edinb. and East of Scot. Col. Agr. Bul. 7, pp. 15*).—Twenty-four varieties of swedes were tested for 4 years. The varieties varied in productiveness and quality, productiveness being more inherent in the variety than quality.

The quality of the crop was influenced by the kind of soil, the size of the roots produced, and the variety grown. Wet and cloudy seasons reduced quality more than quantity. The best producing variety was Premier, which gave on an average fully 1½ tons per acre more than Conqueror, which stood next in the tests. In quality Kinaldie stood first, Stirling Castle second, and New Arctic third.

In the production of dry matter per acre Magnum Bonum and Queen ranked first and second, respectively, with an average difference of ½ cwt. per acre in favor of Magnum Bonum. Next to these varieties in the production of feeding material stood Premier, Paragon, and Stirling Castle.

On the lime factor for the tobacco plant, G. DAIKUHARA (*Bul. Imp. Cent. Agr. Expt. Sta. Japan, 1 (1905), No. 1, pp. 17–22, pls. 3*).—In order to determine the best ratio of lime to magnesia in a soil used for the growth of tobacco a series of pot experiments was made in which ratios of 1, 2, and 4 parts of lime to 1 of magnesia were used. The best results were obtained with a ratio of 4 parts of lime to 1 of magnesia. In all cases the tobacco plants were benefited by the application of lime.

The results of seed tests at the German seed control stations (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 11, pp. 121–123*).—The number of samples tested and the average germination and purity at different seed control stations where this kind of work has been in progress for from 10 to 28 years are given in a table and briefly discussed.

Attention is called to the fact that salable beet seed must come up to the following requirements: A kilogram of beet seed must produce at least 70,000 sprouts in 14 days after planting, and of this number at least 46,000 must be produced in the first 6 days. Of 100 seed bolls not less than 75 must have sprouted in this time. The water content of the seed is considered normal up to 15 per cent, inclusive, and up to 17 per cent, inclusive, the seed may still be sold but a deduction in weight for the extra moisture content must be allowed.

Standard seed may contain 3 per cent of foreign matter, but when the content reaches 5 per cent a deduction in weight must be allowed. Over 17 per cent of moisture or more than 5 per cent of foreign matter in a beet sample makes it unmarketable according to the law.

Report of the seed control station at Vienna for 1905, T. VON WEINZIERL (*Ztschr. Landw. Versuchsw. Oesterr., 9 (1906), No. 3, pp. 279–382, pl. 1*).—A review of the work of the station during the 25 years of its existence is given. During this period 200,867 determinations were made.

A list of 83 seed firms cooperating with the station is given, together with a register of the demonstration fields and forage plant and grass seed culture investigations established and in progress since 1898. The work conducted in the Alpine regions from 1890 to 1905 is described and the different investigations carried on in 1905 are noted.

Studies of weeds. I, Some common thistles, J. PERCIVAL (*Jour. Bd. Agr. [London], 12 (1906), No. 12, pp. 705–715, figs. 10*).—The 4 common thistles *Carduus crispus*, *Cnicus lanceolatus*, *C. palustris*, and *C. arvensis* are described and figured and directions for the extermination of each species are given.

HORTICULTURE.

Pineapple culture. III, Fertilizer experiments, H. K. MILLER and A. W. BLAIR (*Florida Sta. Bul. 83, pp. 405–437, pls. 8, dgms. 3*).—This bulletin contains the detailed plan and results of fertilizer experiments with pineapples, extending over a period of 5 years.

The purpose of the experiment was "to find out from what source or sources it is best to obtain fertilizing materials for pineapples; the proper quantity to use for the best results as regards quantity, quality, and shipping properties; best method of applying; ratio of phosphoric acid, nitrogen, and potash; the effect of shading, and to determine any other conditions which will prove of advantage to the industry."

The experiment contained 96 separate plats, with as many variations and combinations of the fertilizers commonly used for this crop. Each plat contained 100 plants and occupied $\frac{1}{130}$ of an acre. All the plats were covered with a lath shed, furnishing $\frac{1}{2}$ shade. Preliminary to the work pineapples were analyzed with reference to the fertilizer constituents contained to determine the proportion in which they exist normally in the plant and fruit. The ratio of the constituents was found to be practically as follows: Phosphoric acid 0.8, nitrogen 1, and potash 2. The results secured on the different sections of the plats are discussed in considerable detail and illustrations given of the plants on many of the different plats.

Acid phosphate was found to have an injurious effect upon pineapples which could be corrected by the use of lime. It is thought that the acid phosphate itself was not the cause of the injury, but rather the sulphate of iron and aluminum which it contained, since acid phosphate derived from bone black did not have any injurious effect on the plants. Since, however, acid phosphate is occasionally colored to represent dissolved bone black, it is recommended that one not experienced in the use of fertilizers should not use any form of acid phosphate whatever for pineapples, but rely upon bone meal or slag.

On the whole the best results have been obtained by the use of about 3,750 lbs. per acre of fertilizer, analyzing 4 per cent available phosphoric acid, 5 per cent nitrogen, and 10 per cent potash, and this formula was perhaps best compounded by the use of bone, blood, and high-grade sulphate.

A number of fruits were analyzed to see if increasing amounts of fertilizer would affect their composition. The results obtained are tabulated, but the data are not considered sufficiently satisfactory to warrant conclusions.

Among the recommendations and conclusions drawn from the whole work, it is shown that as a source of phosphoric acid fine ground steamed bone, bone meal, and slag have given the best results. If acid phosphate is used lime should be added every year or two at the rate of 750 lbs. to the acre. "As sources of nitrogen, dried blood, cotton-seed meal, and castor pomace may be used. Nitrate of soda may be used for the first 6 months and possibly, to a limited extent, for the first year, but after the first year it will probably be safer to eliminate it entirely. Considerable caution is required in its use.

"Of the potash salts used, high and low grade sulphate have given the best results, the latter seeming slightly the better. Muriate has given fair results, though the sulphate undoubtedly gives better results. Kainit should not be used. High-grade tobacco stems, though not used in this experiment, have been used by a number of growers with good results.

"For most of the east coast soils we would recommend 3,500 to 4,000 lbs. to the acre annually of a fertilizer analyzing 4 per cent available phosphoric acid, 5 per cent nitrogen, and 10 per cent potash, to be applied at the rate of four applications a year for the first 18 months, and after this two applications a year; one in February or March, as the conditions may require, and one soon after the removal of the summer crop."

The use of a growing fertilizer on pineapples at the beginning of winter has been found objectionable, since when the plants are started into growth at this time, they are more easily injured by cold weather which may follow in January or February. Ground tobacco stems may be used in the fall, since this material does not cause much growth, but tends to the production, rather, of hardy plants, better able to withstand the cold.

"Within 3 weeks, or as soon as possible after setting out, the plants should have a light application of cotton-seed meal in the bud, about a tablespoonful to the plant. The first regular application should be put on broadcast about 6 weeks later, and be thoroughly worked in with the scuffle hoe." The experiment brought out clearly that when the quantity of fertilizer was increased from a little more than a ton to nearly 2 tons per acre, the number of larger sizes of pineapples was increased to a very profitable extent.

The pineapple crop was injured in 1905 by a frost in February, and some observations were made to determine the relation between the different fertilizers and the frost-resistance of the crop, but no satisfactory conclusions could be drawn.

Pineapple culture. IV, Handling the crop, H. H. HUME (*Florida Sta. Bul. 84, pp. 441–457, pls. 5, fig. 1*).—In the 3 preceding bulletins on this subject, soils, varieties, and results of fertilizer experiments have been considered (E. S. R., 14, p. 459; 15, p. 468; 17, p. 1154). In the present bulletin the author considers the subject of packinghouses and their equipment, field equipment for the harvesting of pineapples, pineapple packages, harvesting, grading, shipping, and marketing fruit with special reference to Florida conditions.

Relative to the picking of pineapples the author states that before reaching full maturity the pineapple is dark, black-green in color and the eyes somewhat pointed and angular. As maturity advances the eyes flatten down somewhat in the center and become slightly elevated around the margins, and the color changes to a very pale green. "The opening and spreading of the crown may be taken as one of the best indications of maturity. . . . As the fruit ripens the stem elongates, the slips grow rapidly and their leaves spread out." In summer fruit intended for short-distance shipments and immediate consumption the basal eyes may be allowed to retain some color. "If considerable time is to elapse between picking and consumption, the fruit should not be quite so mature."

The mango in Hawaii, J. E. HIGGINS (*Hawaii Sta. Bul. 12, pp. 32, pls. 10*).—A popular treatise on the culture of mangoes in Hawaii. In some experiments made to determine the longevity of mango seeds it was found that of seed 31 to 41 days old, 43.5 per cent germinated and produced good plants. These figures indicate that the seed can be preserved much longer than is generally supposed. An analysis is given of the mango, which shows it to contain 82.51 per cent water, 0.39 per cent ash, 0.01 per cent fat, 1.45 per cent fiber, 0.84 per cent protein, and 14.80 per cent carbohydrates.

Directions are given for the manufacture of chutney, marmalade, and jelly from mangoes, and notes are given on mango breeding, diseases and insects affecting mangoes, varieties of mangoes, and mango seedlings in Hawaii.

Vegetable novelties, F. W. RANE and H. F. HALL (*New Hampshire Sta. Bul. 125, pp. 155–180, figs. 27*).—The results are given of tests of some of the more recent varieties of beans, beets, cabbage, carrots, sweet corn, cucumbers, lettuce, watermelons, pumpkins, squash, potatoes, and tomatoes, with brief descriptive notes. Nitro-culture was used without success in the growing of beans and peas.

Horticultural division, G. S. SCOTT (*Orange River Colony Dept. Agr., Ann. Rpt., 1 (1904–5), pp. 169–181*).—Notes on a large number of fruits planted at various government forestry stations, and of the growing of certain vegetables, particularly potatoes, on the same area.

Flower biology and productiveness of fruit trees, EWERT (*Landw. Jahrb.*, 35 (1906), No. 1-2, pp. 259-287, pls. 2).—Results of extensive experiments are given in which the productiveness of apples and pears, as related to the biology of flowers, was investigated. The special point studied was whether there is anything to fear from the standpoint of self-sterility in making large plantings of a single variety. The following conclusions from the author's work, which extended over a period of 3 years, will show the problems on which data were secured:

Numerous seeds and increased size of fruit accompany each other. Seedless fruits occur not only on such seedless varieties as Vaterapfel and Rihas Seedless, but frequently on trees that usually produce fruit with seeds. Seedless fruits grown on the same tree in competition with seeded fruits are smaller than the latter and frequently misshapen. If foreign pollen is withheld from a tree and only seedless fruits produced, these fruits reach the same size as fruits with seeds. In plantings of a single variety the number of seedless fruits and fruits with but few seeds is relatively high. More fruits with than without seeds are found, however, which indicates that even under such difficult conditions, foreign pollen is carried to the blooms in considerable quantities. Waite's division of fruits into self-fertile and self-sterile sorts requires revision, since fruits may be formed in the absence of pollen.

The experiments which have been made to determine the effect of self-pollination on individual branches of a tree are often of negative value because the enclosing of the blooms results in an unfavorable physiological condition and seedless fruits formed on such branches must compete for nourishment with the seeded fruits on other branches.

There is no basis for the fear that large plantings of a single variety in Germany will result in a decreased yield. The ability of pollen to germinate is variable, but may endure for more than 3 weeks.

Fruits and other food products of Jamaica, E. J. WORTLEY (*Jamaica: Gleaner Co., Ltd.*, 1906, pp. 73, pls. 2).—Brief descriptions and notes are given on the more usual fruits and vegetables grown in Jamaica, as well as such subjects as cloves, coffee, kola, vanilla, sugar cane, etc. The plates show the fruits of all the different plants described.

Influence of colored light on the preservation of ripe fruit (*Mark Lane Express*, 94 (1906), No. 3889, p. 399).—In an article abstracted from the *Bulletin of Agricultural Information*, the results of some experiments are given in which it is shown that ripe fruit can be kept for a longer time under blue glass than under ordinary circumstances. In the experiments cited strawberry plants were grown in pots, and when ripe, part of the pots were placed under red glass and part under blue glass. After a couple of days the fruit under the influence of red light was completely spoiled, while those under blue light kept in good condition for 7 days.

Orchard notes, W. M. MUNSON (*Maine Sta. Bul. 128*, pp. 65-80, pls. 4).—Under the above heading notes are given on spraying, insects and diseases affecting apples, winter injuries to apple trees, mice injuries, and suggestions given as to pruning trees and handling fruit.

The injuries to apples following the severe winters of 1903-4 and 1904-5 were thought to be due to the overbearing of the trees following a dry season and the very cold winter. Trees which were well cultivated and fertilized started a vigorous growth near the base of the main limbs from which it will be possible to build a new top. In neglected orchards or where the thrifty trees were left in sod, the injured trees continued to deteriorate and many have died. In order to prevent future winter injury it is suggested that the trees be not allowed to overbear.

If tar paper is used to protect trees from mice injuries, it is considered important that the paper be removed in the spring; otherwise there is danger of the tree scalding. The cost of sufficient wire screen to protect 400 young trees was $7.50. The tar paper for an equal number cost 84 cts. Strips of wood veneer, which cost

$5 per thousand, were also used successfully, but in applying them the work must be done before freezing weather comes or many of them will crack and be useless. A still cheaper form of protection is a coat of paint, providing pure materials are used.

An obscure physiological disease of apple trees, apparently due to the excessive use of nitrogenous fertilizers and the lack of available potash, is briefly described.

The apples of New York, II, S. A. BEACH, N. O. BOOTH, and O. M. TAYLOR (*New York State Sta. Rpt. 1903, pt. 2, pp. IV + 360, pls. 84*).—This volume is similar in make-up to the preceding (E. S. R., 17, p. 559), and is devoted to summer and fall apples which have originated or are grown in New York. It contains an index of the varieties mentioned in the volume, and also a combined index to volumes 1 and 2.

Apple districts of New York with varieties for each, U. P. HEDRICK, N. O. BOOTH, and O. M. TAYLOR (*New York State Sta. Bul. 275, pp. 61, map 1*).—An alphabetical catalogue is given of the apples that have grown or have originated in New York, in which the characteristics and season of each variety are noted, its suitability for different sections of the State pointed out, and general remarks given on its usefulness.

In addition a discussion is given of the distribution of varieties of apples and the adaptation of groups of apples. Under the latter heading a large number of varieties of apples have been classified into groups, such as Aport Group, Baldwin Group, Early Harvest Group, Fameuse Group, etc. New York State is divided into 9 pomological districts, and lists of varieties which may be successfully cultivated for different purposes given for each. A list of varieties of apples which are unworthy a place among the apples of New York is included in the bulletin, as well as a list of those which have not been sufficiently tested to justify comment on them.

Peach and plum culture, A. B. MCKAY (*Mississippi Sta. Bul. 93, pp. 16, figs. 3*).—An account of the laying out, planting, and yields of a 9-acre peach orchard, 6 acres of which was planted for commercial purposes with 900 Elberta and 50 Triumph peach trees, and the remaining 3 to numerous varieties of peaches and plums.

The orchard was planted during the first days of January, 1898. In 1899 the trees were severely frozen, so that the bark from the ground to the crotches of the lower branches could be easily pulled away from the tree. They were severely headed back and entirely recovered.

Three crops of peaches have been secured from the commercial orchard. The yield in 1901 was 550 bu.; 1902, 520 bu.; and in 1904, 1,575 bu. The total net returns from the shipment of these fruits to St. Louis, Chicago, and St. Paul were $2,500. The first year the orchard was set out sweet potatoes were grown between the rows, and yielded at the rate of 100 bu. to the acre. The next season peas were planted between the rows, and yielded at the rate of 20 bu. per acre. The total receipts from these crops amounted to $390. The cost of the trees and the expense of preparing the land and planting was $66.75. The care of the orchard is placed at $270, making a total expense of $336.75.

There was, therefore, a profit on the crops grown in the orchard of $53.25, which may be regarded as a good rental value on the land for 3 years, at the end of which time the orchard was ready for fruit-bearing, free from encumbrances. For the next 4 years the average returns from the orchard and fruit were $625, or $104.16 per acre. The annual expense of caring for the orchard during this period is placed at $30, leaving a clear gain of $74.16 for each acre during the 4 years.

Brief descriptions are given of 20 varieties of peaches, and of 7 varieties of plums grown in the experimental orchard. Relative to the fruit produced on different kinds of soil, the author states that trees on the stiff, heavy clay over a light-colored, sticky and poorly drained subsoil made a rather unhealthy growth, a large percentage of the trees died, and the fruit lacked color and flavor. "On the deep, strong clay loam

over an orange-colored clay subsoil the trees have grown rather too vigorously." It has been difficult to keep wood growth within proper limits, but "rather more fruit has set on these trees than in other parts of the orchard."

On light, grayish-colored soil the trees are medium sized, require but little pruning, and produce a fair amount of fruit of good quality, but show signs of nearing the end of their period of usefulness. On red clay over deeper red subsoil "the trees are of medium size, but healthy, well shaped, and require but little pruning. The fruit on this section is invariably more highly colored, freer from defects, more uniform in size and shape, and more highly flavored than that from other parts of the orchard."

Peaches for home and market, W. J. GREEN and F. H. BALLOU (*Ohio Sta. Bul. 170, pp. 157–186, figs. 35*).—Popular directions are given for the culture of peaches, including recommendations as to the soil and its preparation, location, trees, planting, cultivation, fruit thinning, etc., with brief descriptions of 30 of the better sorts.

Varieties of strawberries and cultural directions, O. M. TAYLOR (*New York State Sta. Bul. 276, pp. 63–79*).—The author describes 27 of the standard and newer varieties of strawberries which have been grown at the station, and gives brief cultural directions for strawberries.

In 1905 the season was specially favorable at the station for a good strawberry crop. Fairfield and Weston No. 1 were among the earliest of the desirable kinds. Weston No. 1 produced large fruit of desirable size to the close of the season, but Fairfield appeared to be valuable only on account of its earliness. Among the latest sorts were Cardinal, Mark Hanna, Mead, President, Ridgeway, and Rough Rider. All of these, except Cardinal, produced large fruit of desirable size to the close of the season. The author suggests that the varieties Joe and Mead should be planted closer than other varieties. Mark Hanna was the most productive, though low in quality. President was of largest size and an excellent show berry, but deficient in quality. Mark Hanna yielded at the rate of 12,400 qts. per acre, while Midnight, the least productive variety, produced but 1,114 qts. per acre.

Strawberries, O. M. TAYLOR (*New York State Sta. Bul. 276, popular ed., pp. 8*).—A popular summary of the bulletin noted above.

Marketing strawberries (*Country Gent., 71 (1906), No. 2780, pp. 450, 451*).—An account of a successful cooperative society for marketing strawberries, located at Neosho, Mo., with some details as to methods of marketing and doing business.

Longevity of grapes of various varieties and species in north Texas, T. V. MUNSON (*Texas Farm and Ranch, 25 (1906), No. 7, p. 5*).—The author gives the results of growing 69 varieties and species of grapes for 19 years in Texas, on a light sandy soil from 6 in. to 3 ft. deep and resting on red and yellow clay subsoil. The data are largely given in tabular form. They show the names of each variety, its specific blood, the number of vines of each variety planted 19 years before, number and percentage of vines now alive, degree of profitableness, diseases affecting and present condition of each variety.

The author considers the native Post grape (*Vitis lincecumii*) the most valuable of all American species in many respects. It therefore has been used extensively in hybridizing. The article refutes the statement of H. M. Stringfellow to the effect that the Aestivalis types of grapes are the most reliable in the interior of Texas. The tabular data given show a number of varieties superior to these.

Varieties and species of cultivated cacao, M. A. FAUCHÈRE (*Jour. Agr. Trop., 6 (1906), No. 57, pp. 76–79*).—Brief descriptions of varieties and species of cacao, with an account of their respective uses.

Second report on pecan culture, H. H. HUME (*Florida Sta. Bul. 85, pp. 463–501, pls. 8, figs. 14*).—This is a popular bulletin on the pecan, dealing with its botany and culture in Florida. Such matters as propagation, grafting, nursery growing, topworking, preparation of soils, the planting of the orchard, cultivation, fertilizers to use, methods of pruning, harvesting, marketing, and varieties, are considered in

detail. It is similar in character to the two previous bulletins issued on this same subject (E. S. R., 11, p. 57; 12, p. 559).

Relative to budding the author states that the buds now commonly used are those which have been formed just previous to the time of budding. The recommendations of Oliver (E. S. R., 14, p. 968) that dormant buds of last season be used, has not met with favor in Florida because of the large amount of wood which must be sacrificed to secure a few buds. The best trees for planting in the pecan orchard are well grown 1-year-old trees, from 3 to 5 ft. high. The best time to plant is in the latter part of November to the first of February. The 10 varieties which the author believes worthy of cultivation in Florida are described and notes given on their origin.

All the spireas worth growing, J. DUNBAR (*Gard. Mag.* [*N. Y.*], *3* (*1906*), *No. 4, pp. 206–210, figs. 8*).—Of the 50 species of spireas in cultivation in the United States only 14, in the author's opinion, are worth cultivating, and these belong to two great natural groups, the early bloomers, which are white flowered, and the late bloomers, which are some shade of pink, with two exceptions.

The first group is pruned in June; the second in winter. These 14 species are divided into 5 flowering types, each of which is illustrated. The culture of spireas is given, with descriptions of each species of importance. A systematic key or guide is given to the horticultural value of these species.

The American carnation, A. HEMSLEY (*Gard. Chron., 3. ser., 39* (*1906*), *No. 1002, pp. 145, 146*).—The author states that the introduction of the variety Mrs. T. W. Lawson in England has led to the extensive cultivation of American carnations in England, and that the American varieties are far in advance of the English. A number of varieties are described and methods of cultivation discussed.

Further experiments on inheritance in sweet peas and stocks, W. BATESON, E. R. SAUNDERS, and P. C. PUNNETT (*Proc. Roy. Soc.* [*London*], *Ser. B, 77* (*1906*), *No. B 517, pp. 236–238*).—Some of the peculiarities in color inheritance among sweet peas and stocks are pointed out as the result of experimental investigation.

FORESTRY.

The forestry work of the Ohio Experiment Station, W. J. GREEN and C. W. WAID (*Ohio Sta. Circ. 50, pp. 11, figs. 5*).—A considerable amount of cooperative forestry work with farmers is being undertaken. In all 355 plats have been planted to forest trees in different parts of the State under the supervision of the station.

The plan is to give aid to those who wish to help themselves rather than to carry on large forestry operations independently. Some forestry work is being done at the station. In all about 9 acres have been planted to *Catalpa speciosa*, black or yellow locust, Osage orange, white ash, green ash, larch, black walnut, and mulberry. Seedling trees are furnished by the station to farmers without cost.

It is stated that in a catalpa grove 23 years old, the timber value was $326, or $14.17 per acre for each year since planting. In the case of the locust grove 19 years old, the value was $341.76, or $17.98 per acre for each year since planting.

Forest planting in the sand-hill region of Nebraska, G. PINCHOT (*U. S. Dept. Agr., Forest Serv. Circ. 37, pp. 5*).—The results of experiments in growing pine trees on the sand hills of Nebraska seem to indicate that western yellow and jack pine can be successfully used in this region.

The best of the jack pine trees set out on the Bruner plantation in 1890 are now 18 to 30 ft. high. The western yellow pine (bull pine) although not as fast growing as jack pine, is longer lived and is a more valuable tree when matured, and is equally well adapted to the region for planting. Suggestions are given on where to secure planting material and methods of planting. The cost of wild jack pine seedlings is placed at $5 per thousand delivered, and of yellow pine $6 to $15 per thousand. The cost for material and labor is placed at $2.30 per acre.

Review of forest administration in British India, S. EARDLEY-WILMOT (*Rev. Forest Admin. Brit. India, 1903-4, pp. 63, maps 2*).—In addition to the usual data regarding forestry affairs in 1903-4, a 5-year review is given of forestry conditions in India, in which it is shown that the forest area has increased from 81,869 square miles in 1899 to 96,466 square miles in 1904. The working plans at the end of 1904 covered 33,680 square miles. The total cubic feet of timber and fuel cut during this period was 236,016,000. At the same time 214,505,000 bamboos were cut, and the minor forest products amounted to 4,756,000 rupees. The total revenue for the 5-year period was 19,658,000 rupees; the total expenses, 11,269,000 rupees.

Relative to the Imperial Forest School, it is shown that, since its establishment in 1899, 673 students have gone out of the school, of whom 418 are now in government service, 135 in that of native states, etc. The average cost of education per head is 2,606 rupees, without taking into consideration the cost of the buildings.

The appendixes contain the usual data in regard to the forest survey operations, expenditures, receipts, etc. Two large maps of India are given, one showing the distribution of forest lands in India, and the other the forest survey working plans now in operation.

How shall forests be taxed? A. GASKILL (*Forestry and Irrig., 12 (1906), Nos. 3, pp. 119-122; 4, pp. 172-177*).—A paper read before the Society of American Foresters, in which inequitable taxation is held responsible for much of the present forest destruction. Suggestions are given as to the principles which should be applied in the taxation of forests. European systems of taxation are briefly noted.

The author holds that forests should be assessed apart from the land on which they stand, and since they are of public benefit the commonwealth should bear a part of the cost of maintaining them—that is, the State should be made to contribute its share of the cost, as well as the counties in which the forests are located. The greater part of the tax on the forest should fall due when the timber is sold, and the deferred tax should bear a fair relation to the net yield of the property. The owner is entitled to a fair annual return on his investment.

In the enactment of future tax laws relative to forest property, three considerations should enter. "(a) Necessity—the support of the local government; (b) equity—an assessment based upon the actual yield, collection of the tax (on the trees, not on the land) deferred until the crop is sold, and a recognition of the peculiar risks—fire, trespass, etc.—to which forests are subject; (c) encouragement—a special rating of the property to compensate the owner for whatever expense attaches to maintaining the forest in a condition that best serves the public interest."

Kealia forest reserve (*Hawaii. Forester and Agr., 3 (1906), No. 2, pp. 61-68*).—This proposed forest reserve contains 9,935 acres. Its purpose is to protect the natural forest covering the watershed of the northern end of the Puna District of Kauai. A description is given by the superintendent of forestry, R. S. Hosmer, of the lands and forests included.

Ewa forest reserve (*Hawaii. Forester and Agr., 3 (1906), No. 2, pp. 68-79*).—Recommendations, with resolutions relating to the establishment of Ewa forest reserve, are given, with a report by the superintendent of forestry on the area of land included, and an account of the forest. The purpose of the reserve is to insure the continuance of the forest on the Koolau Mountains, and to increase its efficiency as a protection forest by bringing the area under a system of forest administration. The total area of the whole reservation is approximately 28,550 acres.

The black wattle in Hawaii, J. G. SMITH (*Hawaii Sta. Bul. 11, pp. 16, pls. 3*).—The results are given of harvesting a 6-acre grove of Australian black wattle (*Acacia decurrens*) about 13 years old, and directions given for the cultivation and harvesting of this tree in Hawaii. Some data are also given on the influence of climate on the tannin content of black wattle, the production of tan-bark extracts, details of

tanning processes, and suggestions on what to do with the wood. The insect enemies of black wattle in Hawaii are briefly enumerated by D. L. Van Dine.

The wattle appears to thrive best in Hawaii on rather heavy soils at an elevation of 800 to 3,000 ft., where the rainfall ranges from 80 to 150 in. per annum. The 6-acre tract harvested grew on a steep slope at an elevation of 600 to 800 ft. It yielded 38 tons of bark. The 36 tons which were sold brought $839.44, and in addition 500 fence posts and 88 cords of firewood were secured. The firewood was sold for $689.25, making the total value of the tract a little over $1,600. The trees at this time had reached their full development and during the preceding 4 years about 20 per cent of them had died, some because they had reached their limit of growth, and others on account of injury from stock and insects.

Under methods of cultivation, it is stated that 1 lb. of seed will plant 10 acres. Before planting, the seed should be either covered with boiling water and allowed to stand 24 hours, or scorched in hot ashes to soften the hard outside skin to facilitate germination. It is considered more economical to plant the seed in place than to sow in nursery rows and transplant. The trees on good soil should be ready to cut in 10 years. In the station grove trees of the same age varied from 18 in. at the butt, when growing on rich soil with heavy rainfall, to only 6 in. in diameter on rocky thin soil at a lower and drier elevation. Ten-year-old trees should yield at least 100 lbs. of green bark, equal to 50 lbs. of dry bark. It is considered doubtful whether black wattle can be profitably cultivated except on land of fairly good character.

The best bark was obtained by drying under roofs. The main point seems to be to dry in such a manner that the bark will not mold. Where sufficiently large areas are to be harvested, the author believes it would pay to build a large drying house carrying temporary slatted floors 18 in. apart, on which the green bark, cut into lengths of 2 or 3 in., could be uniformly distributed for drying.

In investigating the influence of climate on the tannin content it was found that in the case of koa bark (*Acacia koa*), that taken from trees above Hilo showed 17 per cent tannin, while samples taken from a much drier district showed only 12 per cent. Samples of wattle bark taken from trees growing in a very wet district showed fully as high tannin content as trees growing in a very dry district. The range of tannin in this bark varied from 25 to 36 per cent. No apparent relation was found between the tannin content and the soil or season. The highest yield, therefore, of tannin per acre can be secured from lands on which the trees during the normal growth will produce the largest amount of bark, and this is likely to be obtained where the rainfall is sufficiently heavy to afford the trees uninterrupted growth.

The wood is stated to be hard and tough, and comparable with algeroba in fuel value, but somewhat more difficult to split. It checks in drying. Some suggestions are given on its use in making wood alcohol. It is estimated that 200 acres of ground planted to black wattle would yield 500,000 cu. ft. of wood in 10 years. By distillation this would give a minimum of 1,650 tons of charcoal, 15,000 gal. of wood spirits, 380 tons of acetate of lime, and a large amount of wood tar and creosote, having a total value of $44,000, while the cost of production should not exceed $20,000.

How to prune young locust and catalpa trees, W. J. Green and C. W. Waid (*Ohio Sta. Circ. 51, pp. 6, figs. 3*).—Locust trees are nearly self-pruning. They have a tendency to produce one fork and if this is removed, no attention need be paid to the smaller limbs. With the catalpa the authors recommend the cutting off of the tree to the level of the ground when 2 or 3 years old and allowing but one sprout to develop from the stump. If the trees have made a good root growth, they may be cut back the second year, but if not, pruning should be deferred until the third year. Late winter or early spring is considered the best time for cutting back.

Northern limit of the papaw tree, C. A. WHITE (*Science, n. ser., 23 (1906), No. 593, pp. 749–751*).—A discussion of the distribution in the United States of the papaw (*Asimina triloba*), persimmon, and pecan.

Packing seeds for the Tropics, J. H. HART (*Gard. Chron., 3. ser., 39 (1906), No. 1010, pp. 275, 276*).—The author calls attention to the necessity of packing seeds intended for the Tropics in dry air and in tinfoil packets in order to preserve their ability to germinate. He cites an instance in which English peas imported into Trinidad in ordinary packets gave a 95 per cent germination when first sown. The sowing a month later gave 75 per cent. At the third sowing, 30 days later, the percentage of germination was 40, and at the fourth sowing the percentage of germination was but 20.

Suitability of New South Wales timbers for railway construction (*Indian Forester, 32 (1906), No. 2, pp. 74–77*).—This is a review of the report of the forestry branch of New South Wales for 1904–5.

It appears that the timber area of commercial value in New South Wales is about 20,000,000 acres, or 10 per cent of the area of the State. Up to 1904 about 7,503,200 acres of the forest area had been examined and reserved from sale. The value of the timber exported has risen from $225,145 in 1895 to $794,230 in 1904. Ironbark is used largely for piles, trams, girders, and transoms of bridges because of its strength and durability. Tallowwood, gray and red gum, blackbutt, and Sydney blue gum for decking and light scantling, and turpentine and ironbark for jetty and pier work.

Under favorable conditions ironbark has lasted 40 years as bridge timber, and turpentine piles have been found perfectly sound after standing 40 years in salt water. It is stated that Australian hardwoods last much longer in the track than the timbers commonly used in Europe and North America.

Report on the turpentine industry in the United States, BELL (*Diplo. and Cons. Rpts. [London], Misc. Ser., No. 647, pp. 17*).—A report on the turpentine industry in the United States by the British commercial agent, the data for which are largely based on the reports of the U. S. Department of Agriculture.

DISEASES OF PLANTS.

Notes on miscellaneous diseases, K. MALKOFF (*Ghodishen Otchet Drzhavnata Zeml. Opitna Stantziya Sadovo, 2 (1904), pp. 156–233 [German Summary], pp. 19–22, pls. 3*).—Notes are given on a number of diseases and insect injuries of economic plants.

Among the subjects treated are the spot disease of chick-peas due to *Ascochyta pisi*, which the author says may be controlled with Bordeaux mixture; the control of plum pockets with 3 per cent Bordeaux mixture; combating rose rust with Bordeaux mixture; the brown rot of plums (*Monilia fructigena*); a bacterial disease of mulberries; the use of Paris green, tobacco extracts, etc., against insects; and critical notes on plant diseases observed in Bulgaria in 1904.

Laboratory notes, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt., 13 (1905), pp. 405–428, pls. 19, figs. 5*).—Brief descriptive notes are given on a number of diseases of plants. Among them are a disease of Swedish turnips (*Phoma napo-brassicæ*), apple and pear canker (*Nectria ditissima*), apricot coral spot (*N. cinnabarina*), onion mildew (*Peronospora schleideni*), bean anthracnose (*Colletotrichum lindemuthianum*), broad bean rust (*Uromyces fabæ*), hollyhock rust (*Puccinia malvacearum*), a number of diseases of roses, club root of cabbage (*Plasmodiophora brassicæ*), etc.

Contribution to the life history of some Uredineæ, E. FISCHER (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 7–8, pp. 227–232*).—Notes are given on *Pucciniastrum padi* and *Puccinia liliacearum*.

Investigations on the stinking smut of wheat and its control, K. MALKOFF (*Ghodishen Otchet Drzhavnata Zeml. Opitna Stantziya Sadovo, 2 (1904), pp. 139–149,*

[*German Summary*], *pp. 12-14*).—The author investigated the effect of time of seeding on smut production, seed treatment with fungicides, and varietal resistance. No striking differences could be noted in the amount of smut that could be attributed to the time of seeding.

In the experiments for seed treatment the effect of hot and cold ashes, dry air, cold water and milk of lime, Bordeaux mixture, hot water, copper sulphate solutions, formalin, and corrosive sublimate solutions were tested. All the treatments reported diminished the germinative ability of the wheat to some extent, the least injury reported being with the lots of seed treated with 0.1 per cent formalin, followed closely by the lot soaked for 5 minutes in Bordeaux mixture. The seed of the different lots was sown and counts made of all smutted stalks and heads.

Practically all smut was prevented by the treatments with Bordeaux mixture, formalin, and 0.5 per cent copper sulphate solution, each treatment being about the same in efficiency. Mixing the grain with dry ashes immediately after thrashing was next in efficiency, only 3.5 per cent of the plants and 2.5 per cent of the heads being smutted.

Marked differences in varietal susceptibility are noted.

Investigations on the mosaic disease of tobacco, F. W. T. HUNGER (*Ztschr. Pflanzenkrank., 15* (*1905*), *No. 5, pp. 257-311, fig. 1*).—A review is given of the various theories regarding the cause of the mosaic disease, particular attention being given the bacterial theories of Mayer, Iwanowski (E. S. R., 13, p. 361), and Prillieux and Delacroix (E. S. R., 5, p. 1019), and the theories of Beijerinck (E. S. R., 10, p. 1058), and Woods (E. S. R., 13, p. 146; 14, p. 264), after which the author states and elaborates his theory regarding the causes of this disease.

According to the author's view any disturbances in the normal metabolism of the plant may result in the variegation characteristic of the mosaic disease. He holds that the immediate cause of the disease is an unorganized ferment of the toxophore group of Oppenheimer rather than oxidizing enzyms, as proposed by Woods and others. The mosaic disease must not be confused with variegation as it occurs in ornamental plants, which has been shown to be a not infrequent phenomenon in certain species of Nicotiana. It is also said to differ from the disease described by Sturgis under the name "calico" (E. S. R., 11, p. 755).

Some of the factors favoring the mosaic disease are described and the results of investigations on meteorological conditions and soils in Java are given. A bibliography of literature relating to this subject completes the article.

Combating the mosaic disease of tobacco, H. JENSEN (*Centbl. Bakt.* [*etc.*], *2. Abt., 15* (*1905*), *No. 13-14, pp. 440-445*).—In commenting upon the possibility of combating the mosaic disease through breeding experiments, the author briefly describes an experiment which he thinks shows the impossibility of producing resistant races within a single year, as has been claimed by others.

The author believes it will be possible to develop resistant varieties, but that it will be found best to work with resistant races within varieties of known quality, rather than attempt to develop new types whose chief recommendation is hardiness or resistance.

Potato diseases, T. W. KIRK (*New Zeal. Dept. Agr. Ann. Rpt., 13* (*1905*), *pp. 346-363, pls. 6, figs. 2*).—A brief account is given of spraying experiments which successfully reduced the percentage of loss due to various potato diseases, and descriptions are given of the following diseases of potatoes: Late blight (*Phytophthora infestans*), early blight or leaf curl (*Macrosporium solani*), bacteriosis (*Bacillus solanacearum*), scab (*Oospora scabies*), dry rot (*Fusarium oxysporum*), a wet rot which is believed to be of bacterial origin, and brown spot, which is of an uncertain cause. Where known, suggestions are offered of means for preventing these diseases.

Note on the facultative saprophytism of Alternaria solani, A. H. COCKAYNE (*New Zeal. Dept. Agr. Ann. Rpt., 13* (*1905*), *pp. 428-430*).—A report is given of a

series of experiments with *Alternaria solani* to determine whether it has lost its power of developing saprophytically.

Healthy leaves and leaves infected with *Phytophthora infestans* were inoculated with conidia of *A. solani*, and after developing, the spores were gathered and sown on leaves attacked by the late blight. These infections were repeated for six generations, when the conidia were sown on healthy leaves and kept in a damp chamber. The conidia germinated freely, but the mycelium was poorly developed and no spotting of the leaves resulted, the mycelium appearing to live almost entirely on the surface of the leaves.

It appears that through a space of six generations this fungus, which has become parasitic, was so reduced through gradual adaptation as to be converted into an obligate saprophyte.

Heart rot of beets, mangels, and Swedish turnips (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 10, pp. 596–598, fig. 1*).—A description is given of a disease, attributed to the fungus *Sphærella tabifica*, which is said to be not uncommon in France, where it causes considerable damage to sugar beets. In England the fungus has recently made its appearance, being particularly destructive to mangels and Swedish turnips.

The disease rarely appears before the middle of August, and first attacks the stalks of the largest leaves. Its presence is indicated by the wilting of the leaves, such as follows a hot, dry day; during the night the diseased leaves do not recover, but remain lying on the ground, turn yellow, and decay. Later in the season, when the leaf stalks are dead and dry, a second form of fungus fruit appears on the bleached patches, and some time later the mycelium of the fungus passes into the crown of the root, gradually extending downward. Finally the entire root is reduced to a blackish decayed mass.

The fungus seems to be able to pass the winter in diseased roots left in the field, and where the disease appears, it is recommended that the crop should be harvested immediately and all diseased leaves and roots gathered and burned or deeply buried.

Yellow varieties of mangels appear to be more susceptible to disease than others, as shown by infection experiments.

The drop disease of cabbage, J. RITZEMA BOS (*Tijdschr. Plantenziekten, 11* (*1905*), *pp. 105–117, pls. 3*).—A description is given of a disease of cabbage said to be due to *Phoma oleracea*. It has appeared in some of the most important cabbage growing districts of Holland and is proving quite destructive.

Three fungus diseases of the cultivated ginseng, H. S. REED (*Missouri Sta. Bul. 69, pp. 43–66, figs. 9*).—According to the author, ginseng plantations have increased in number and extent so that ginseng now constitutes an important crop in the State.

The first occurrence of disease on ginseng plants was reported in 1904. At that time the disease seemed to be due to a leaf-spot fungus, and it was thought that spraying with Bordeaux mixture might keep it in check. Later investigations showed that a number of diseases were present and they were not similar to those described from New York (E. S. R., 16, p. 271). On this account the author made a detailed study of the diseases and the fungi causing them. The diseases described are stem anthracnose, leaf anthracnose, and wilt.

The stem anthracnose is due to the fungus *Vermicularia dematium*, and it makes its appearance about 30 days after the plants appear above the ground, producing numerous black scars on the stems of the plants. The stalks are frequently so badly attacked that they break off before the upper portions become wilted. The direct injury is due to the filaments penetrating the cortical and sclerenchyma layers, disintegrating them, and later breaking through the epidermis and forming black spore-producing bodies This disease can be readily checked by the use of Bordeaux mixture.

The leaf anthracnose, caused by *Pestalozzia funerea*, made its appearance early in July, when black, velvety patches were observed at the bases of the leaves and flower stalks causing them to die and fall off. This form of anthracnose caused the death of thousands of young plants, and it was found that it also could be kept in check by spraying with Bordeaux mixture.

The wilt disease described is due to *Neocosmospora vasinfecta*, and this trouble has proved a very serious one, whole plantations often being destroyed in a single week. As the name suggests, the disease is to be recognized by the wilted appearance of the plants, and in this respect it greatly resembles the wilt of cotton, watermelon, and cowpeas. In fact, the fungus is considered identical with that causing the wilt of those plants.

The author investigated the entrance of the fungus through the roots, but a careful examination failed to show any signs of fungus infection. There was evidence, however, for believing that the fungus enters the plant at the base of the stem through the lesions caused by the stem anthracnose. This is shown from the facts that careful microscopical examination failed to reveal the presence of any fungi in the young parts of the roots, that where as a result of spraying there was no anthracnose fungus the plants were not affected by the wilt, and that the wilt disease never appeared until about 2 months after the stem anthracnose had made its appearance.

The fungus is not found except in the fibrovascular bundles while the plant is alive, while it is very customary to find the spore balls in the interior of dead, hollow stems, etc. The observations of the author have led to the conclusion that the wilt disease can be controlled by keeping the plants free from anthracnose and other fungi which produce lesions on the stems.

A technical account is given of the diseases and of the fungi causing them.

A Phytophthora rot of apples, etc., A. OSTERWALDER (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *15* (*1905*), *No. 13–14*, *pp. 435, 440*).—Following a severe rain and hailstorm in June, 1904, apples were found affected with an unusual rot. Upon investigation the cause was determined to be *Phytophthora omnivora*, and inoculation experiments showed the possibility of its causing the rotting of apples and pears within a relatively short time.

Notes on the so-called closed canker of apple trees, K. VON TUBEUF (*Naturw. Ztschr. Land u. Forstw.*, *3* (*1905*), *No. 2*, *pp. 92–94*, *figs. 2*).—The author describes an unusual form of apple-tree canker, in which the fungus stimulates the tree into the production of large knotty outgrowths. When sawed through, the perethecia of *Nectria ditissima* were found inside the knots.

A bacterial disease of cherry trees, R. ADERHOLD and W. RUHLAND (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *15* (*1905*), *No. 12*, *pp. 376, 377*).—A preliminary note is given on a bacterial disease of cherry trees that has been quite destructive in some of the Rhine provinces of Germany.

This disease appears to have been hitherto confused with that described as due to the fungus *Valsa leucostoma* (E. S. R., 15, p. 270), but it lacks the characteristic outgrowths of that disease. The organism has been isolated and cultivated, and inoculation experiments show that it is capable of causing the trouble. The bacterium is described by the authors as *Bacillus spongiosus*. The disease is believed to be widely distributed throughout Germany. The authors intend further studies upon it, and suggest that it may also attack other stone and pomaceous fruit trees, as similar appearances have already been noticed on plum and apple trees in the vicinity of Dammkrug.

Observations on the biology of the olive-tubercle organism, E. F. SMITH (*Centbl. Bakt.* [*etc.*], *2. Abt.*, *15* (*1905*), *No. 7–8*, *pp. 198–200*, *pl. 1*).—The author was led to investigate the organism causing the olive knot (*Bacillus oleæ*), to confirm statements by Schiff (E. S. R., 16, p. 987) relating to the biology of the bacillus.

The organism was isolated from olive knots from California, and studied under various conditions, comparisons being made with organisms plated out from material received from two different sources in Italy. In all of the material examined there

were found to be in addition to *B. oleæ* a number of other organisms. Successful inoculation experiments were made with the organisms from California and Italy.

The author failed to find resemblances between his bacteria and that described by Schiff, and he concludes that no olive knots can be produced with pure cultures of the spore-bearing organisms described by Schiff.

Investigations on olive tuberculosis, R. SCHIFF (*Centbl. Bakt.* [*etc.*], *2. Abt., 15* (*1905*), *No. 7–8, pp. 200–211*).—The results of the author's investigations on the cause of the olive tuberculosis and studies on the biology of the organism are given, a preliminary account of which has been noted elsewhere (E. S. R., 16, p. 987).

The occurrence and prevention of gooseberry mildew, R. EWERT (*Naturw. Ztschr. Land u. Forstw., 3* (*1905*), *No. 5, pp. 200–204*).—Attention is called to the occurrence of *Glœosporium ribis* on gooseberries, the fungus causing serious injury to the plants.

An experiment in preventing the mildew was carried on in which the shrubs were sprayed with ordinary Bordeaux mixture, milk of lime, iron-free Bordeaux mixture, Bordeaux mixture to which varying proportions of iron sulphate were added, and soda Bordeaux. The shrubs were sprayed twice during the season, and the effect as shown on the bushes is described. The author recommends in general the spraying of the shrubs with a 1 per cent solution of ordinary Bordeaux mixture. He also recommends that resistant varieties, as far as possible, be planted, and that they be stimulated to rapid growth by means of cultivation and the use of fertilizers.

The American mildew of gooseberries, J. RITZEMA BOS (*Tijdschr. Plantenziekten, 11* (*1905*), *pp. 170–176*).—Notes are given on the gooseberry mildew (*Sphærotheca mors-uvæ*), which has recently appeared in a number of places in Europe, where it seems to be very destructive. The fungus and its effect on the host are described, and suggestions given for its prevention.

Further investigations on the bacterial disease of sesame, K. MALKOFF (*Ghodĭshen Otchet Drzhavnata Zeml. Opītna Stantzīya Sadovo, 2* (*1904*), *pp. 149–156,* [*German Summary*], *pp. 14–19, pls. 5*).—In continuation of a previous note (E. S. R., 16, p. 65) the author gives additional accounts of the biology of the organism causing the wilt of sesame.

The disease is still poorly known but may be recognized by the stems of badly infested plants being wilted and affected with a sort of black rot, while those less seriously attacked are checked in their growth and as a result the crop yield is considerably lowered. Repeated experiments in the isolation and cultivation of the organism and the results of inoculation experiments are described in detail. Field experiments showed that plants from early-sown seed seemed more subject to disease, and moist soils also favored its development. Treating the seed grain with a 0.1 per cent solution of formalin seemed to restrict the spread of the disease in some of the experiments.

Concerning witches brooms of pear trees, F. MUTH (*Naturw. Ztschr. Land u. Forstw., 3* (*1905*), *No. 2, pp. 64–76, figs. 11*).—A description is given of witches brooms occurring on wild pear trees, the outgrowths being attributed to attacks of *Exoascus* sp.

Witches brooms of Quercus rubra, SOLEREDER (*Naturw. Ztschr. Land u. Forstw., 3* (*1905*), *No. 1, pp. 17–23, fig. 1*).—A description is given of witches brooms found upon the American red oak in a garden at Erlangen, Bavaria.

These growths have previously been reported as occurring on *Quercus ilex*, caused by the fungus *Exoascus kruchii*, and on *Q. lobata*, due to *E. quercus lobatæ*, but the cause of the witches brooms on the red oak is thought to be an entirely distinct species of fungus from those mentioned above. A list is given of trees known to be subject to these growths and, so far as known, the fungi which cause them.

[illegible] subsequent note, by K. von Tubeuf (same journal, No. 7, pp. 309, 310, figs. [illegible]ccurrence of these growths on red oak in other localities is mentioned.

Witches brooms of fir trees, K. von Tubeuf (*Naturw. Ztschr. Land u. Forstw., 3 (1905,) No. 6, pp. 253–260, figs. 5*).—Illustrated descriptive notes are given on a number of forms of witches brooms observed on fir trees.

Notes on Thelephora laciniata, K. von Tubeuf (*Naturw. Ztschr. Land u. Forstw., 3 (1905), Nos. 2, pp. 91, 92, fig. 1; 4, pp. 187–189, figs. 3*).—Brief accounts are given of attacks of *Thelephora laciniata* on young fir trees. The fungus, while not a true parasite, surrounds the lower parts of the seedling, ultimately causing its destruction. Very small seedlings are especially subject to attack. Moisture favors the development of the fungus. The seedlings should be thinned and stimulated by the use of fertilizers to make rapid growth. The same fungus is reported as injuring one-year-old beech seedlings.

Further studies on Melampsora occurring on willows in Switzerland, O. Schneider (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 7–8, pp. 232–234*).—The results of inoculation experiments with *Melampsora ribesii-grandifoliæ* and *M. larici-reticulatæ* are given, in which notes are presented on the teleutospore and Cæoma stages of the fungi.

The occurrence of timber dry rot in Russia, L. von Lubimoff (*Ztschr. Österr. Ingen. Architekt. Ver., 1905, p. 363; abs. in Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 9, pp. 269, 270*).—The rapid extension of railroad building, in which construction timber so largely enters, has served to call attention to the timber dry rot caused by *Merulius lachrymans*. The loss due to this fungus is said to be very great. To prevent its attack various preservatives have been employed, such as carbolineum, creosote, various tar oil and proprietary compounds, corrosive sublimate, etc., and notes are given on their use and relative efficiency.

A sclerotium disease of Forsythia, A. Osterwalder (*Ztschr. Pflanzenkrank., 15 (1905), No. 6, pp. 321–329, pl. 1*).—A description is given of a disease of the ornamental shrubs *Forsythia intermedia* and *F. suspensa* which is attributed to *Sclerotinia libertiana*, and the relation of certain conidia to the fungus is discussed. The stems, leaves, and flowers of the shrubs appear to be subject to attack of the fungus, which has proved quite destructive. The disease has been noticed for several years, but a careful search made in the spring of 1905 failed to show the wintering form of the fungus through the development of germinating sclerotia.

The resistance of various varieties of roses to rust, R. Ewert (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 6, pp. 249–252*).—In 1903 investigations were begun at the Botanical Institute of Proskau on the rose rust due to *Phragmidium subcorticium*, and observations were made on the relative susceptibility of various classes and varieties of roses to the fungus, the observations being extended to cover the years 1903 and 1904.

Except in the hybrid perpetual class there was relatively little disease either year, and during 1904 there was much less than was observed the previous season. The meteorological data show that the rainfall from April to August in 1904 was only about one-third of the amount recorded in the previous year. The results of the observations are tabulated, from which it appears that the hybrid perpetuals as a class are more subject to attacks of *P. subcorticium* than any of the others studied.

A competitive test of spraying apparatus, J. Ritzema Bos (*Tijdschr. Plantenziekten, 11 (1905), pp. 81–96, pls. 2, figs. 8*).—A report is given of the jury designated to award the prizes of the Pomological Society of Holland for hand, knapsack, and power sprayers. The jury in making its award took into consideration the size, weight, apparent durability, cost, relative efficiency, fineness of spray, etc. First and second prizes and honorable mention were awarded in each class.

ECONOMIC ZOOLOGY—ENTOMOLOGY.

Bark ringing by woodpeckers and its relation to forest insects, G. FUCHS (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 8, pp. 317–341, pl. 1, figs. 7*).—It has been shown by various authors that woodpeckers may attack healthy trees making a ring of punctures around the trunk and causing an outgrowth of a shelf-like structure at such points.

It appears that some of the species of woodpeckers are fond of the sap obtained in such outgrowths. It has also been observed that these ring structures may become infested with insects and are visited by woodpeckers in search of food. The author believes that on the whole woodpeckers are of more benefit in the destruction of injurious insects than harm as a result of injury to trees.

The pine squirrel as a forest pest, RUDOLF KOCH (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 7, pp. 298–303, fig. 1*).—The author presents details regarding the nature of injury to the twigs of pines and fir trees by pine squirrels. The idea that these injuries are more often due to the attacks of *Garrulus glandarius* is without foundation.

The loss of terminal twigs through the agency of pine squirrels, K. VON TUBEUF (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 11, pp. 476–478, fig. 1*).—According to observations made by the author all of the terminal twigs of pine trees eaten off by pine squirrels were subsequently replaced by lateral twigs which, however, grow considerably less rapidly than uninjured terminal twigs. The injury from pine squirrels is, therefore, considered as a serious matter.

Cases of bark injury due to the pine squirrel (Sciurus vulgaris), K. EPPNER (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 3, pp. 112–120, figs. 3*).—According to the author's observations various species of pine are at times greatly injured by the pine squirrels gnawing off the bark and biting off the terminal branches. Several illustrations of this work of the pine squirrel are given which indicate that the injury from this squirrel may assume a serious character.

The determination of generic types, and a list of roundworm genera, with their original and type species, C. W. STILES and A. HASSALL (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 79, pp. 150*).—Much confusion has prevailed in zoological literature on account of the uncertainty regarding scientific names and the authors believe that this is partly due to a failure to designate type species for genera at the time of their erection. The discussion presented in this bulletin is designed to prevent, as far as possible, further confusion.

A historical review is given of the principles of type designation, together with copies of the British Association Code, the Dall Code, the code of the American Ornithologists' Union, and of the German Zoological Society, as well as other rules proposed by the various individuals and associations. The principles maintained in the bulletin are illustrated by application to a list of genera of roundworms.

The synonymy of Tænia, T. crassicollis, T. marginata, T. serrata, T. cœnurus, T. serialis, and Echinococcus, C. W. STILES and E. C. STEVENSON (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 80, pp. 14*).—This bulletin contains a detailed synonymy of species contained in the subgenera Tænia and Tæniarhynchus as well as the species socialis in the genus Multiceps.

International catalogue of scientific literature. N—Zoology (*Internat. Cat. Sci. Lit., 3 (1905), pp. XI + 438*).—The bibliographical references included in this volume are based mainly on literature published in 1903. It includes also certain articles published in 1901 and 1902. The bibliographical titles are grouped according to zoological classification.

The fauna of British India including Ceylon and Burma. Butterflies, I, C. T. BINGHAM (*London: Taylor & Francis, 1905, pp. XXII + 511, pls. 10, figs. 94*).—This volume is the first of a series of three which are being prepared by the author to

contain information regarding all the butterflies known to occur in British India. This work has been undertaken to supplement and complete that of de Nicéville. In the introduction to the volume the anatomy and classification of butterflies are briefly discussed. The families considered in this volume are Nymphalidæ and Nemeobidæ.

Report of the entomologist, C. P. GILLETTE (*Colorado Sta. Rpt. 1901, pp. 13-18, figs. 10*).—A summary is presented of the work thus far done at the station on codling moth. It appears that the eggs of the spring brood are deposited both on the fruit and leaves. Two applications of Paris green resulted in the saving of 25 to 90 per cent of the apples.

An examination has been made of a large number of bees with reference to the length of the tongue. The author has thus far been unable to find any evidence of a long-tongue race of Italian bees although several so-called long-tongue and red-clover bees have been examined. The length of the tongue in various races of bees ranges from 0.23 to 0.27 in. Brief notes are also given on sugar-beet insects and on a number of miscellaneous insects including Howard's scale, apple aphis, plum gouger, etc.

Dangerous insects and diseases and their treatment, L. R. TAFT (*Mich. Bd. Agr., Nursery and Orchard Insp. Bul. 1, pp. 16*).—The author briefly describes the purpose of the Michigan nursery and orchard inspection law and presents notes on San José scale, European fruit scale, scurfy scale, oyster-shell bark-louse, apple and peach aphis, cankerworm, crown gall, black knot, pear blight, peach yellows, little peach, and methods of fumigating nursery stock.

Insect pests in West Australian orchards and vineyards, F. LOWE (*Jour. Dept. Agr. West. Aust., 12 (1905), Nos. 4, pp. 302-307; 5, pp. 425-432*).—Attention is called to the climatic and other conditions which may exert an influence in determining the prevalence of insect pests and in affecting the relative abundance of parasitic insects. The subject of importation of parasitic insects is also discussed.

Particular attention is given to an account of the habits, life history, and means of combating the codling moth. In spraying for this insect the author recommends the use of Paris green at the rate of 1 oz. in 10 gal. of water to which 8 oz. of lime are added.

A preliminary list of the more injurious insects of Texas, with notes on distribution (*Texas Agr. and Statis. Rpt., 18 (1905), pp. 261-276*).—Some insect pests of the State are listed under the head of the plants which they affect.

Entomological notes, J. KOTINSKY (*Hawaii. Forester and Agr., 3 (1906), No. 1, pp. 8-11*).—Brief notes are given on the use of soap washes in the destruction of scale insects. A soap wash made in the proportion of 1 lb. of soap to 4 gal. of water has been used against the purple scale with satisfactory results in nearly all cases. Recommendations are also made regarding spraying apparatus.

A yearly programme in entomological practice for the orchard, H. A. GOSSARD (*Ohio Sta. Circ. 52, pp. 4*).—Recommendations are made regarding various insecticide operations to be applied in various months to apple, pear, quince, peach, plum, and cherry trees.

Spraying calendar, S. A. BEACH and E. E. LITTLE (*Iowa Sta. Bul. 85, pp. 39-53, figs. 2*).—In an introduction to this bulletin attention was called to the extent of damage caused by insects and fungus diseases in Iowa. The bulletin contains definite recommendations regarding the time for applying various insecticide and fungicide treatments and the materials and formulas to be used. The methods of preparing various spray mixtures are described.

The mealie stalk borer, C. W. MALLY (*Agr. Jour. Cape Good Hope, 27 (1905), No. 2, pp. 159-168, pl. 1*).—*Sesamia fusca* is a regular pest of corn in South Africa. The insect feeds upon corn, Kafir corn, and occasionally on other products. There appear to be only two well defined broods annually.

In controlling this pest it is recommended that old stalks should not be left in the field, but should be burned. In this manner the winter protection for the pest will be removed. Cornstalks may also be plowed under, but this is less effective, since they may not all be buried to a sufficient depth. Losses from the insect in question can not be materially reduced by late planting. A number of parasitic enemies are known, but they are not capable of reducing the number of the pest materially.

The preservation of maize during transport by the Clayton process (*Sci. Amer. Sup., 61 (1906), No. 1571, pp. 25177, 25178, figs. 10*).—Brief notes are given on the various uses of corn and the methods of transporting it from one country to another. In such transportation maize may be attacked by beetles, and for destroying insect pests in corn sulphur fumigation by means of the Clayton apparatus has been found very efficient. The apparatus is suited to disinfection of dwelling houses and other buildings as well as ships. The apparatus in question distributes sulphur dioxid, sulphur trioxid, and other gases through the infested material, and destroys insects in such material.

The control of micro-lepidoptera injurious to grapes in France, J. DEWITZ (*Centbl. Bakt. [etc.], 2. Abt., 15 (1905), No. 15-16, pp. 449-467*).—The most important micro-lepidoptera which attack grapes in France are *Tortrix pilleriana, T. ambiguella,* and *Eudemis botrana.*

In treating infested grapes in winter good results have been obtained from spraying with boiling water. Grapevines may also be sprayed with good results by the use of a mixture of lime, coal tar, caustic soda, and carbon bisulphid in water. Some of the insects in the winter stage may be destroyed by scraping the bark from grape trunks or by inclosing the trunks and fumigating with sulphur. Infested trunks may also be sprayed with a mixture of 10 kg. coal tar, 2 kg. oleic acid, 0.5 kg. caustic soda in 90 liters of water. In controlling these pests in summer some success has been had from the use of lantern traps, sticky substances, and various insecticides in weak solutions.

Combating phylloxera in 1904, D. CAVAZZA (*Ann. Uffic. Prov. Agr. Bologna, 11 (1904), pp. 41-74*).—A meeting was held in Imola at which measures were adopted regarding the control of phylloxera. As a result of this meeting measures were taken to determine the present status of infestation and the results of previous work in controlling the phylloxera. A committee was also appointed to study the distribution of American grape roots in the infested region and measures concerned with the control of the pest.

The grape phylloxera in Hesse, W. SCHUSTER (*Ber. Oberhess. Gesell. Nat. u. Heilk., 34 (1905), pp. 105-127, figs. 2*).—A brief historical statement is given regarding the introduction of the grapevine phylloxera into Hesse and its subsequent distribution. Particular attention is given to a statistical account of the prevalence of this pest from 1878 to 1902.

Natural enemies of the fruit fly, C. P. LOUNSBURY (*Agr. Jour. Cape Good Hope, 27 (1905), Nos. 3, pp. 309-319; 4, pp. 457-469*).—A visit was made to Brazil for the purpose of investigating fruit flies and their parasites with a view to the importation of possible beneficial parasites. The author and Mr. Fuller spent considerable time studying the conditions of the problem in localities where Mr. Compere had previously worked.

As a result of the investigations it is concluded that the efficiency of natural enemies of the fruit flies found in Brazil has been greatly overestimated by Mr. Compere. The fruit fly *Ceratitis capitata* is a serious pest in various parts of Brazil and appears not to be held in check by its natural enemies. Another serious fruit fly pest is *Anastrepha fratercula* and is also not greatly affected by natural parasites. The staphylinid beetle reported by Mr. Compere as an important enemy of the fruit fly was not found at all by the author.

In search of parasites, G. Compere (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 6, pp. 547, 548*).—A short popular account is given of a recent visit to China in search of the parasites of red scale and purple scale and the announcement is made that in the near future an attempt will be put forth to secure parasites of the potato moth and woolly aphis.

Some tree and wood-infesting insects. Cabbage snakes, H. Garman (*Kentucky Sta. Bul. 120, pp. 45-81, pls. 4, figs. 6*).—The elm-leaf beetle has gradually spread over the eastern part of the State, where it has destroyed many neglected elms, particularly the imported species.

The use of bands about the trunks of elms is without effect in keeping the insects away from foliage, but sticky bands or other obstructions may be used for attracting the insects at the time of pupation. In one case more than 13,000 beetles were destroyed in this way about the base of a single tree. Just as effective work, however, may be accomplished by the use of scalding water or kerosene from time to time. The beetles on the foliage may be destroyed by the use of Paris green at the rate of 1 lb. per 100 gal. of water, together with 1 lb. of slaked lime or arsenate of lead at the rate of 3 to 4 lbs. per 100 gal. of water.

Notes are presented on insects affecting oak and other trees. Oaks are attacked by leaf miners and *Kermes pubescens*. The latter may be destroyed by spraying with lime-sulphur-salt wash. Brief accounts are presented of walnut worm, cottonwood leaf beetle, vagabond gall louse, poplar leaf tyer, willow leaf beetle, willow flea beetle, willow slug, apple-tree measuring worm, cicadas, June bugs, and other forest insects.

Considerable injury is reported to casks from the attacks of bark beetles, particularly *Monarthrum fasciatum* and *M. mali*. The wood of vinegar barrels, beer kegs, wine casks, etc., was perforated by small holes which were most numerous near the hoops and at the joints between the staves. Since these insects bore into the wood in hope of finding fungus upon which to live, it is desirable to treat the casks so as to destroy the fungus. For this purpose Bordeaux mixture, copper sulphate, lime-sulphur wash, or bisulphite of lime are useful. The attack of the beetles is largely prevented by scalding the casks and treating them with lime.

On account of the unusual popular interest aroused in cabbage snakes, some attention was given to this subject. The term "cabbage snake" appears to have been applied to a slender species of Mermis which is parasitic in the bodies of a number of insects. In some localities the term has also been used for *Geophilus bipunticeps*.

The black locust tree and its despoliation, C. A. White (*Pop. Sci. Mo., 68 (1906), No. 3, pp. 211-218*).—On account of the fact that the black locust is a rapidly growing tree it has recently been planted on an extensive scale for the production of railroad ties and for other purposes. The author believes, however, that on account of an attack of three especially injurious insects on the plantations, these trees are doomed to failure.

These pests are a leaf miner, gall insect, and the locust borer (*Cyllene robiniæ*). The last-named insect is the most injurious, burrowing through the trunk and larger branches, and rendering the wood unfit for use. Infestation by this pest is not observed at once; in fact the tree may be practically ruined for economic purposes without injury to the bark. The locust borer is exceedingly injurious wherever the black locust occurs in this country except in parts of California. Notes are given on the habits and life history of this pest and on possible remedies.

No effective remedies, however, have been devised. The application of repellent washes to the trunks of trees is suggested, but would be rather expensive.

The root-louse of the Norway spruce, A. Jacobi (*Tharand. Forstl. Jahrb., 55 (1905), No. 3, pp. 177-197, pl. 1*).—The habits and life history of *Rhizomaria piceæ* are described in considerable detail.

This insect appears on the roots of the Norway spruce, and, when present in large numbers, sucks the juice from the roots to such an extent that the trees are greatly weakened, or, in some cases, killed outright. In combating this pest, the best results have been obtained from the use of carbon bisulphid mixed with molasses and placed in the soil about the roots of infested trees. The molasses serves to hold the carbon bisulphid for some time, allowing it gradually to escape and produce its effect upon the insects. The insecticide may be injected into the soil by means of a syringe or placed in a furrow around the trunk.

The number of annual generations among the bark beetles, E. Knoche (*Naturw. Ztschr. Land u. Forstw., 3 (1905), Nos. 9, pp. 353–368; 10, pp. 401–415*).—The literature relating to the biology of various species of bark beetles is critically reviewed.

The author concludes from the study of literature and from his own observations that the question whether a given species of bark beetle produces 1 or 2 generations annually depends not so much upon the species as upon the temperature of the locality where the beetle is found. Nevertheless under given conditions different species do not vary in this respect, but each one shows the same number of generations from year to year.

Tomicus typographus, O. Nüsslin (*Naturw. Ztschr. Land u. Forstw., 3 (1905), Nos. 11, pp. 450–468; 12, pp. 481–493, fig. 1*).—This insect is described in its various stages with special notes on its occurrence in Herrenwies and Pfullendorf in 1905. In order to control this beetle it is very desirable that infested trees should be cut and removed from the forest before the beetles have emerged. This and the maintenance of trap trees are about the only practical remedies for the control of the pest.

Pissodes harcyniæ, G. Fuchs (*Naturw. Ztschr. Land u. Forstw., 3 (1905), No. 12, pp. 507, 508, pl. 1*).—This insect is reported as occurring in large numbers in June on pine trees. As a result of the injury due to the beetle, infested trees became subsequently diseased through the attacks of *Trametes pini*.

Lophyrus similis, W. Baer (*Naturw. Ztschr. Land u. Forstw., 4 (1906), No. 2, pp. 84–92, figs. 3*).—This sawfly is described with notes on some related species and on anatomical features which serve to distinguish it from the other species. Particular attention is given to the biological and morphological differences between *L. similis* and *L. pini*.

Progress made in exterminating the fever tick in North Carolina, T. Butler (*Raleigh: N. C. Dept. Agr., 1906, pp. 4, figs. 3*).—The attention of cattle raisers is called to the fact that during the past 4 years 10 counties in North Carolina have been freed from cattle ticks and placed above the Federal quarantine line. The author considers that his experiments have demonstrated the feasibility of exterminating cattle ticks in all sections where stock laws prevail. It is believed that the ticks may be exterminated at a smaller cost than the annual loss due to cattle ticks in the affected regions.

Fowl tick experiments, F. H. Robertson (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 6, pp. 561–563*).—It was found that fowl ticks remain alive at least 2 years and 3 months without the presence of any fowls from which to derive nourishment. In these experiments the ticks were maintained in small pill boxes which were practically air tight. In the nymph stage ticks may live for 2 months without food.

A classification of the mosquitoes of North and Middle America, D. W. Coquillett (*U. S. Dept. Agr., Bur. Ent. Bul. 11, tech. ser., pp. 31, fig. 1*).—On account of the requests received by this Department from students of entomology, physicians, and sanitary officials regarding the identification of mosquitoes in various parts of the country, the present bulletin is prepared to furnish information along this line. The external anatomy of mosquitoes is briefly described, together with notes on the subfamilies, a table for identifying these subfamilies, and also analytical

tables for the identification of the genera and species of mosquitoes recognized in North and Middle America

Household insects, W. LOCHHEAD (*Canad. Ent., 38 (1906), No. 3, pp. 65-70, figs. 3*).—Notes are given on the habits and life history of house flies, mosquitoes, fleas, bedbug, carpet beetles, clothes moths, larder beetles, mites in cheese, ham, and flour, flour beetles, meal worms, and red ants. Practical methods of combating these pests are suggested for each species.

Report of the committee on apiary, J. W. NELSON (*Ann. Rpt. Penn. Dept. Agr., 10 (1904), pp. 381-383*).—The winter of 1904 is said to have been one of unusual severity for bees. Notes are given on the quality of honey obtained from various kinds of plants with particular reference to its color and taste. Attention is called to the desirability of a stringent law in Pennsylvania regarding the eradication of foul brood.

Apiculture in Cuba, E. W. HALSTEAD (*Estac. Cent. Agron. Cuba Circ. 20, pp. 11, pls. 3, fig. 1*).—Brief historical notes are given on the development of apiculture in Cuba, the management of bees, artificial swarming, introduction of queens, extraction of honey, foul brood, and other diseases of bees.

Age at which bees first carry pollen, C. C. MILLER (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 3, pp. 245, 246*).—The difficulty experienced in determining this matter is considerably increased by the fact that bees so often attempt to rob honey from other colonies and in many instances become confused and enter the wrong hives. The author made a number of observations on this subject and will continue his investigations.

Japan's three silk crops, F. A. VIVANTI (*Yokohama: Japan Gazette Press, 1905, pp. 10*).—The great increase in the silk industry in Japan during the past 30 years is attributed by the author to the improved methods which have been adopted, so that three crops of silkworms may be fed annually.

Formerly sericulture was confined almost entirely to the northern provinces of Japan, but now this industry flourishes throughout the islands. The method by which the three crops of silkworms are fed annually is based on the use of cold storage. A large supply of eggs are placed in cold storage in the fall and carried over to the following spring. In May, when the first mulberry leaves appear, about 65 per cent of the eggs are taken out of cold storage and hatched. After about one month one-half of the remaining eggs are in turn taken out and hatched, thus producing the summer crop of cocoons which are ready for reeling in July or August. About a month later, the rest of the eggs are taken from cold storage and hatched, so as to produce the autumn, or third crop.

Streptococcus bombycis in relation to emaciation and flaccidity of the silkworm, S. SARTIRANA (*Centbl. Bakt. [etc.], 1. Abt., Orig., 40 (1905), No. 2, pp. 207-211; 40 (1906), No. 3, pp. 331-336*).—The author studied the morphology and biology of this micro-organism with special reference to its connection with emaciation in silkworms.

As a result of numerous inoculation experiments, it is concluded that the micro-organism in question must be considered as the only specific cause of this disease. It is found chiefly in the alimentary tract, and causes local lesions, which lead to chronic enteritis. Flaccidity, however, can not be considered as a peculiar disease caused by one micro-organism alone; it is rather a mixed infection due to a number of micro-organisms, including streptococci.

FOODS—HUMAN NUTRITION.

Food and diet in health and disease, R. F. WILLIAMS (*Philadelphia and New York: Lea Bros. & Co., 1906, pp. X+392, fig. 1*).—This volume, which is designed as a text-book for students, has two main divisions, the first treating of food in health and the second of food in disease.

Available data are summarized regarding the chemistry of foods, the physiology of digestion, the changes brought about by cookery, the characteristics of different food groups, feeding in infancy and old age, as well as special diets suited to different diseases, preparation of foods for invalids, and related questions, the volume as a whole constituting a concise summary of the subject of nutrition from the physician's standpoint.

In his introduction the author states that the first half of the volume, which deals with nutrition and food in health, is largely based on the results of the nutrition investigations which have been carried on under the auspices of the Office of Experiment Stations.

A new method of indicating food values, I. FISHER (*Amer. Jour. Physiol., 15 (1906), No. 5, pp. 417–432, figs. 23*).—A system of expressing the nutritive value of food is described in which a quantity yielding 100 calories is selected as the basis for comparison. The author believes that this gives a better idea of the relative nutritive value of different foods than the usual method of expressing percentage composition.

A method is described in which a right-angled triangle is divided in such a way that composition is expressed graphically. The author has devised an instrument by which the nutritive value of a food or diet may be estimated according to his system.

An inquiry into the extent of underfeeding amongst the school children of Blackburn, A. GREENWOOD (*Blackburn, Eng.: Times Printing Works, 1905, pp. 76*).—From a careful study of the existing conditions it is stated that probably not more than 1.3 per cent of the Blackburn school children are underfed. The author believes that "considerable waste occurs in many homes through a lack of knowledge as to cheap nutritious articles of diet and economical cooking. . . . It is important that the elder girl scholars should be taught the preparation and cooking of such meals as are available in a workingman's home."

The function of cellulose in the diet of man, I, H. LOHRISCH (*Ztschr. Physiol. Chem., 47 (1906), No. 2–3, pp. 200–252*).—A large amount of experimental data is reported on the digestibility of cellulose supplied by a number of common food materials.

The results obtained showed that with normal digestive apparatus cellulose is more or less well digested, and indeed under some circumstances is thoroughly digested, the thoroughness of digestion being indirectly proportional to its hardness. On an average the normal subjects studied by the author digested 57.9 per cent of the cellulose, patients suffering from chronic constipation 81.4 per cent, and those suffering from other diseases amounts to considerably less than normal.

The question of cellulose digestion, the author believes, will not be understood until the ferments inducing it, at present unknown, are identified and studied. The article contains a review of earlier investigations and a bibliography.

The influence of the dietary on the constituents of the urine, A. DESGREZ and J. AYRIGNAC (*Compt. Rend. Soc. Biol. [Paris], 60 (1906), No. 13, pp. 616–618*).—The proportion of different constituents of the urine and their relation to each other was studied on an absolute and mixed milk diet, milk and egg diet, vegetarian diet, and mixed diets containing large and small amounts of meat.

The ratio of nitrogen of urea and total nitrogen reached its minimum in the vegetarian diet and its maximum in the absolute milk diet. The ratio of uric acid to urea was greatest on a vegetarian diet and least on a mixed diet containing large

amounts of meat. The phosphoric acid and sulphur constituents of urine were also studied.

The effect on metabolism of overfeeding protein, M. SCHREUER (*Arch. Physiol.* [*Pflüger*], *110* (*1905*), *No. 3-4, pp. 227-253*).—The investigations showed that feeding large quantities of protein did not permanently increase the protein content of the body. An increased oxygen consumption was noticed in experiments with dogs when large amounts of protein were taken, which indicated an increased cell activity, but this increase in the material stored in body cells was not found to be permanent.

Protein feeding and the estimation of glycogen, E. PFLÜGER (*Arch. Physiol.* [*Pflüger*], *111* (*1906*), *No. 7-8, pp. 303-308*).—For exact estimations of glycogen the author insists that his cuprous-oxid method should be used.

Some considerations on proteid diet, L. F. BARKER and B. A. COHOE (*Jour. Biol. Chem.*, *1* (*1906*), *No. 2-3, pp. 229-238*).—Using Hausmann's method, the amid, melanoidin, diamino, and monamino nitrogen was determined in veal cutlet, pork chop, beef sirloin, beef tenderloin, beef neck, heart, liver, thymus, chicken, and trout, with a view to determining something regarding composition and differences in food value. The various forms of nitrogen were rather evenly distributed in the foods analyzed.

The chemistry of flesh, IV. A study of the proteids of beef flesh, P. F. TROWBRIDGE and H. S. GRINDLEY (*Jour. Amer. Chem. Soc.*, *28* (*1906*), *No. 4, pp. 469-505*).—The conclusions drawn from an extended chemical study of the proteids of beef flesh were in effect as follows:

The total acidity of aqueous extracts of flesh varies between comparatively wide limits, the minimum being 0.66 per cent, the maximum 1.07 per cent, and the average 0.85 per cent, calculated as lactic acid and expressed in terms of the fresh substance of the meat. The residues of flesh which are left after the complete extraction with cold water are distinctly acid to litmus and to phenolphthalein. On the other hand, the insoluble proteids of flesh upon digestion with decinormal hydrochloric acid at ordinary temperature combine with it and neutralize its acid properties.

Analyses made by the authors show that 13.56 per cent of the total proteid existing in lean beef flesh is soluble in cold water. Of this total soluble proteid 90.04 per cent is in a form which is coagulable by heat from a neutral solution, 8.40 per cent exists as albumoses and a very small quantity apparently exists in the form of peptones. Presumably, the albumoses and peptones do not exist as such in the original flesh. During the coagulation of an aqueous extract of flesh there is an increase in its acidity. Reduction of the acidity of aqueous extracts of flesh facilitates coagulation of the proteids.

There are no well-defined degrees of temperature at which different coagula of aqueous extracts of flesh separate. The complete removal of the proteid coagulating at any fixed definite temperature requires long application of heat. Further, the lower the temperature at which a coagulum is separated, the longer the time of heating required to effect complete coagulation.

The chemical composition of the different fractional coagula of the aqueous extracts of raw flesh is remarkably constant. They are also quite similar as regards their chemical constitution judging from the results of their hydrolysis.

Raw flesh which has been completely freed from proteids soluble in cold water contains two classes of proteid substances, those which are soluble in a 10 per cent solution of ammonium sulphate and those which are insoluble in this medium.

For earlier work see E. S. R., 17, p. 886.

The globulin of muscle fibers, L. MOROCHOWETZ (*Physiol. Russe*, *4* (*1905*), *No. 61-67, pp. 42-52*).—A historical account is given of the globulin of lean meat (myoglobin), the chemistry of the subject, and related questions, and the results of studies of preparation, characteristics, and properties reported. According to the author,

if repeatedly dissolved in ammonium-sulphate solution and precipitated with this or some other salt a product is finally obtained which, after dialysis, contains only an inappreciable quantity of ash.

The globulin of egg yolk, L. MOROCHOWETZ (*Physiol. Russe, 4 (1905), No. 61–67, pp. 53–59, fig. 1*).—Historical and other data are summarized regarding globulin of egg yolk (vitelloglobin) and studies of its preparation and properties reported. When free from fat and other contaminating bodies, this globulin did not differ from other globulins in respect to its solubility in a solution of common salt or other salts.

The liver as a storehouse for protein, W. SEITZ (*Arch. Physiol. [Pflüger], 111 (1906), No. 7–8, pp. 309–334*).—In experiments with chickens the conclusion was reached that protein is stored in the liver.

The effect of constituents of low-grade flour on the extraction of gluten and upon bread-making properties, LINDET and L. AMMANN (*Ann. Chim. Analyt., 10 (1905), No. 12, pp. 454–456; 16–17, pp. 1005–1014*).—The difficulty experienced in extracting gluten of low-grade flour, according to the investigations reported, is due to its acidity and to the presence of a mucilaginous substance and of small carbohydrate particles derived from the bran, which become mixed with the gluten particles and prevent agglutination. To facilitate the determination of gluten this bran material should be removed by the action of ferments and the acid and mucilaginous material by extraction with water.

In the second paper, which gives a more extended account of the investigations, the authors conclude that glutenin is made up of fine particles which are not very coherent embedded in a mass of gliadin which imparts the agglutinating properties. The effect of heating at different temperatures and related questions are considered.

The acidity of bread and its causes, H. STIEGELER (*Pure Products, 2 (1906), No. 4, pp. 183–186*).—The acid reaction of bread is due either to free organic acid or to acid potassium phosphate. The formation of acid in flour and leaven, as pointed out, must be attributed to micro-organisms and particularly to bacteria, and a number of sorts of bacteria which produce acid in bread are described.

"When pure yeast is employed in the preparation of the bread, the product exhibits a low acidity; the dough is then so rapidly raised by the growth of the yeast cells and of their fermenting power, that the acid-forming bacteria have no chance to develop. This is the case also with rye bread, whose normally rather high acidity is not derived from the flour. It is the use of impure yeasts, of sour milk and of rancid butter which produces the high acidity in bread leavened with yeast. The acids of bread do not appear to lower its nutritive value, yet a very sour bread will interfere with the digestion of many persons."

The nutritive value of Corsican chestnut flour, P. COMTE (*Jour. Pharm. et Chim., 6. ser., 22 (1905), No 5, pp. 200–210, fig. 1*)—Composition, charateristics, and microscopical structure of Corsican chestnut flour are considered, as well as its nutritive value and place in the diet. According to analyses it contains somewhat less protein and somewhat more nitrogen-free extract than wheat flour. The author considers it a palatable and valuable food product.

Study of apple marc, W. D. BIGELOW and H. C. GORE (*Jour. Amer. Chem. Soc., 28 (1906), No. 2, pp. 200–207*).—The data reported show that the hot-water extract, constituting 40 per cent of apple marc, consists of one carbohydrate complex, a galacto-araban.

"The carbohydrate complexes in case of the alcohol precipitate of apple must, and in case of the alcohol precipitate of second pressing ciders, are both higher in galactan, relative to the pentosan content, than the hot-water extracts of apple marc. The treatment with boiling water lessens the yield of crude fiber and cellulose, and at the same time gives a purer fiber and a purer cellulose." (See also E. S. R., 17, p. 465.)

Changes in the composition of the fruit of cucurbits, LECLERC DU SABLON (*Compt. Rend. Acad. Sci. [Paris], 140 (1905), pp. 320, 321*).—The sugar, starch, and

water content of different sorts of cucurbit fruits was determined before, during, and after maturity. The sugar, which was abundant in the unripe fruit, diminished during the ripening processes, increased after the fruit was ripe and again diminished. The starch content increased until the fruit was harvested and then diminished, while the water content first increased, then diminished markedly at maturity, and afterwards increased.

The chemistry of celery (Apium graveolens), I, M. Bamberger and A. Landsiedl (*Monatsh. Chem., 25 (1904), pp. 1030–1034; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 10 (1905), No. 10, p. 619*).—In the roots of tuberous rooted celery the authors report 0.48 per cent asparagin, and a smaller amount of tyrosin in addition to mannit. Leucin was not found.

The absorption of sulphurous acid from the air by meat, A. Kickton (*Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, pp. 324–328*).—The experiments showed that when sulphurous acid was present in air meat would absorb it, the surface containing considerably more than the interior.

Evaporated cream (*Mo. Bul. Bd. Health Mass., n. ser., 1 (1906), No. 3, p. 61*).—Determinations of fat showed that so-called evaporated creams were merely unsweetened condensed milks, having somewhat the consistency and appearance but neither the taste nor physical characteristics of cream.

The artificial coloring of mustard, P. Köpcke (*Pharm. Centralhalle, 46 (1905), p. 293; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, pp. 349, 350*).—The method of detection suggested depends upon the extraction of the coloring matter with ammonia and showing the presence of artificial coloring matter by dyeing a sample of woolen goods.

Honey vinegar, J. J. Hofmann (*Pharm. Weekbl., 42 (1905), pp. 704, 705; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, p. 356*).—Honey vinegar is manufactured on a commercial scale in Holland. A number of samples were examined and found to possess an agreeable aroma and taste.

Report of work in the food and drug laboratory, H. E. Barnard and J. N. Hurty (*Mo. Bul. Ind. Bd. Health, 7 (1905), No. 11, pp. 130–144; 8 (1906), No. 1, pp. 5–21*).—Over 50 per cent of the foods, condiments, and beverages examined under the provisions of the State pure food laws were found to be adulterated.

The pure food and drug laws of the State of Indiana (*Mo. Bul. Ind. Bd. Health, 7 (1905), Nos. 7, pp. 75–88; 8, p. 95*).—The legislative enactments regarding pure food and drugs in the State of Indiana and the food and drug rules of the State Board of Health are quoted.

The pure food law in Germany, its origin and growth, and its effect upon the commercial food industry and upon diet, A. Juckenack (*Deut. Vrtljschr. Öffentl. Gsndhtspflege, 37 (1905), pp. 678–688; abs. in Ztschr. Untersuch. Nahr. u. Genussmtl., 11 (1906), No. 6, pp. 358, 359*).—The growth, development, and results of the German pure food law are discussed. In the author's opinion this law is responsible for a great improvement in the quality of food products and in food considered from a sanitary standpoint.

ANIMAL PRODUCTION.

The composition of some Hawaiian feeding stuffs, E. C. Shorey (*Hawaii Sta. Bul. 13, pp. 23*).—Proximate and ash analyses are reported of a number of samples of sorghum, sugar cane tops, millet, Kafir corn, wild and cultivated grasses, alfalfa, wild cowpea, cowpea, 2 sorts of Desmodium, pigweed, sow thistle, *Commelina nudiflora*, *Bidens pilosa*, prickly pear, *Acacia farnesiana*, banana tops and butts, taro tops, sweet potato tops, ti leaves (*Cordyline terminalis*), cassava roots, brewers' grains, molasscuit, algeroba beans (whole beans—pods and seeds), rice bran, rice polish, and cocoanut meal. In addition to the usual constituents the percentage of total, proteid, and amid nitrogen was determined.

A fact of special interest brought out by the bulletin is that a number of Hawaiian feeding stuffs, particularly those belonging to the grass family, are deficient in lime, and that the failure to obtain the best results, which has sometimes been noticed with a ration which was apparently well balanced, may be attributed to this cause. In order to secure the best results in bone development, health, etc., the author believes that such feeding stuffs should be supplemented by others richer in lime, as leguminous plants, algeroba beans, and sugarhouse by-products, or by the use of more lime either in the drinking water, mixed with the feeds used, or applied to the soils producing the forage crops.

"While the analyses reported in this bulletin are not considered sufficiently numerous to warrant any extended comparison of Hawaiian feeding stuffs with one another or with those of other regions, or to justify elaborate discussion of the best ways of utilizing the various feeding stuffs in Hawaiian practice, they do show that the Hawaiian feeder has at his command a quite large and varied assortment of feeding stuffs, many of which are of high nutritive value, and it is believed that the information given in the bulletin will aid the feeder in selecting from the feeding stuffs available those which will give him the cheapest and most efficient rations for his stock."

Analysis of fodder plants, E. A. MANN (*Jour. Dept. Agr. West. Aust., 13 (1906), No. 2, pp. 142–145*).—Among the plants analyzed were black boy leaves, grass tree leaves, African wonder grass, and *Eragrostis pilosa*.

Feeding stuff inspection, C. D. WOODS and J. M. BARTLETT (*Maine Sta. Bul. 129, pp. 81–100*).—Under the State feeding stuff law analyses were made of a number of samples of cotton-seed meal, cotton-seed feed, linseed meal, viscid oil meal, gluten meals and feeds, distillers' grains, molasses feeds, mixed and proprietary feeds, corn meal, hominy meal, wheat bran, wheat middlings, mixed wheat feed, oats, beef scrap, and similar goods.

With the exception of samples of cotton-seed meal submitted by jobbers for the purpose of learning their quality, the authors state that they found no cotton-seed meal which was below the Cotton-seed Crushers' Association standard for prime goods.

Inspection of concentrates, J. B. LINDSEY ET AL. (*Massachusetts Sta. Bul. 108, pp. 51*).—The concentrated feeds analyzed under the State law include blood meal, cotton-seed meal, linseed meal, oil meal, viscid oil meal, gluten meal and feed, brewers' and distillers' dried grains, malt sprouts, wheat middlings, mixed wheat feeds, wheat bran, dairy feeds, sugar feeds, rye feeds, buckwheat feeds, calf meal, corn meal, hominy meal, provender, corn and oat feeds, oat feeds, dried beet pulp, corn bran and similar goods, cereal breakfast food by-products, meat scraps and similar goods, dried fish, granulated milk, poultry feeds, and alfalfa and clover meals.

The various corn and oat feeds, the authors state, may be divided into two classes, namely, those consisting largely of oat refuse with some corn, frequently of low quality, and occasionally a little red dog middlings, and those consisting principally of hominy, to which has been added more or less oat offal. The feeding stuffs included in the first class have a rancid, bitter taste, while those in the second group are generally sweet and more attractive. Such goods are inferior to clean, bright corn or hominy meal, yet, as the authors point out, they cost nearly or quite as much.

"Alfalfa [meals], as well as clover meals, are now obtainable for winter feeding. The former should carry 18 per cent protein, and the latter 12 per cent. Preference should be given to bright, clean lots, free from excess of coarse, woody stalks. The price ($1.80 a hundred) is rather in excess of their value. Poultrymen, by raising corn and clover, can considerably reduce their outlay for food. . . .

"Molasses may constitute one-sixth to one-fourth of the grain ration for horses ([illegible] pint to one quart daily). A larger quantity tends to make them logy. The [illegible] amount may be fed daily as a constituent of the grain ration for dairy stock."

The inspection of feeding stuffs in 1905, F. W. MORSE (*New Hampshire Sta. Bul. 124, pp. 147–152*).—Analyses are reported of 84 samples of cotton-seed meal, linseed meal, gluten meal, gluten feed, distillers' grains, hominy feed, compounded cattle foods, vegetable poultry foods, animal meal and similar poultry foods, and bone meal.

The following statements are quoted from the discussion of the analytical data:

"There were found to be 3 distinct classes of cotton-seed meal, according to the percentage of protein, being guaranteed, respectively, to contain 38.5 per cent, 41 per cent, and 43 per cent. . . . The prices were practically alike for all three grades. This is an injustice to the consumer because the lowest grade contains more lint and hulls than the highest grade. The consumer, however, can protect himself by reading the tags on the sacks. . . . Two brands of so-called mixed feed were collected, which were not pure wheat products. One contained corncob and gave an exceptionally high fiber, while the other was made up largely of screenings, finely ground. They complied with the law in bearing proper labels, but one was inferior to its stated composition. . . .

"There are no failures on the part of any of the poultry foods to reach the percentage guaranteed, while some of the animal meats and scraps overrun heavily, especially in fat. Excessive amounts of fat would not seem advantageous for laying hens, however."

Licensed concentrated feeding stuffs, F. W. WOLL and G. A. OLSON (*Wisconsin Sta. Bul. 134, pp. 17–23, 27–30*).—A list of the feeding stuffs licensed for sale during the calendar year 1906 is given, together with the guaranty of their protein and fat content. The text of the State feeding stuff law is quoted.

The nutritive value of the nonproteid nitrogen compounds in feeding stuffs, E. SCHULZE (*Jour. Landw., 54 (1906), No. 1, pp. 65–81*).—A summary and discussion of available information concerning the nonproteid constituents of feeding stuffs. The author considers that many of these constituents possess considerable nutritive value, while others are of little or no importance in nutrition. In the latter group, asparagin and perhaps glutamin are included.

Experiments on the value of asparagin and lactic acid in the feeding of Herbivora, O. KELLNER (*Verhandl. Gesell. Deut. Naturf. u. Aerzte, 76 (1904), II, 1. Abt., p. 145; abs. in Centbl. Agr. Chem., 35 (1906), No. 1, pp. 45–48*).—From experiments with sheep the conclusion was reached that neither asparagin nor lactic acid bore any part in the gains which were made. The author believes that asparagin has a value in that it tends to prevent the lowering of digestion noted with a very low proteid diet and so acts indirectly and in a limited way as a protector of protein.

Digestion experiments with forage plants, H. G. KNIGHT (*Wyoming Sta. Rpt. 1905, pp. 52–60*).—Experiments on the digestibility of alfalfa hay by sheep gave the following average coefficients: Dry matter, 63.39; protein, 79.67; fat, 41.20; ether extract, 74.08; crude fiber, 44.84, and ash, 56.17 per cent.

Feeding beef cattle in Mississippi, A. SMITH and C. I. BRAY (*Mississippi Sta. Bul. 92, pp. 24, figs. 10*).—To study the relative merits of feeding in a warm stable and an open yard and to compare a mixed ration of hay and grain with one of cotton-seed meal and hulls only, a feeding test was undertaken with 5 lots of steers. Three of the lots were made up of 5 animals, one of the lots of 7, and one of 3 animals. The cattle in the latter lot were scrubs and the others thrifty animals and medium feeders. Three of the lots were fed in a stable and two in yards, one with and one without an open shed for shelter, the mixed ration and the cotton-seed meal and hull ration being so arranged that each was tested under the 2 conditions of feeding. The test covered approximately 14 weeks.

Considering the thrifty animals fed in stalls the average gain on the mixed ration was 201 lbs. per steer and on the ration made up of cotton-seed products 185 lbs. per steer, the cost of a pound of gain in the 2 cases being 8.5 cts. and 6.1 cts. The scrub

steers fed in a stall made an average gain of 130 lbs. at a cost of 10.7 cts. per pound. The steers fed the mixed ration in a yard gained on an average 196 lbs. at a cost of 9.13 cts., and the similar lot fed the ration of cotton-seed products gained 146 lbs. at a cost of 8.2 cts.

The manure may be more readily saved when the steers are fed in stalls. Its estimated value in the test reported was $80.

Following are some of the authors' conclusions:

"The comparison between the stable versus open yard system while showing some advantage in favor of the stable method really indicates that a combination of the best features of both systems is preferable. This could be done by allowing the cattle to run in large sheds with a solid tight floor which should be well bedded, and the manure all saved. If desired, outside yards connected with these sheds could be provided, so that the cattle could have some exercise and plenty of fresh air. One of the secrets of successful cattle feeding is in making them as comfortable as possible.

"Where cotton-seed meal and hulls can be purchased at a reasonable price, they prove to be very cheap feeds for fattening steers. No bad effects result from feeding cotton-seed meal for such short periods as this, and it remains to be seen whether any ration can be compounded exclusive of good silage, which can equal it as an inexpensive feed.

"Dairy farming has many points of superiority over beef raising, but to farmers who are not close to a good market and are handicapped by lack of available and steady labor, the breeding and feeding of cattle will offer many inducements. That it is a profitable business in the South is shown by the low cost of raising cattle, economy in producing suitable feeds, and the inexpensive buildings required. With a good pure-bred beef sire, a herd of native cows, and plenty of pasture land, a farmer may in 2 or 3 years' time develop a good grade beef herd, which will largely increase his profits and maintain the fertility of the soil."

Summary of swine feeding, 1904-5, G. E. Morton (*Wyoming Sta. Rpt. 1905, pp. 44-47*).—Many believe that corn is necessary for pork production, and a comparison of wheat and corn was made with 2 lots of 3 pigs each. In 11 weeks the total gain on wheat was 342 lbs. and on corn 229 lbs.

In a second test wheat and alfalfa hay with and without roots were studied with 2 lots of 2 pigs each. In 13 weeks the lot fed roots gained 183 lbs. and the lot without roots 185 lbs. "Evidently the roots fed did no good in anyway; they were simply an additional expense."

Judging by both tests "straight wheat feeding gives the best gains of any of the rations tabulated, but it also involves very heavy grain feeding [8 to 24 lbs. per day at the end of the test] to get the gain."

"An answer to the question whether this extra gain and less amount of concentrates is offset by the cost of the alfalfa hay depends upon the comparative cost of the feeds in a given locality."

A sow weighing 341 lbs. was fed for 14 weeks beginning December 3, alfalfa hay and roots only, consuming on an average 6 lbs. of the hay and 6 to 24 lbs. of the roots per day. At the end of the period she had lost 7 lbs

Three sows fed corn, shorts, and alfalfa hay gained 122 lbs. in 6 weeks. "The gain shown . . . is good and the sows were apparently put in good condition for pigging by this ration. One sow gave birth to 7 living pigs and 1 dead pig; the other gave birth to 5 living and 3 dead. Further experimentation will be required to determine whether the ration was responsible for the stillbirths."

Corn and shorts, corn and alfalfa hay, and wheat and corn each with alfalfa hay chopped in swill were compared with 4 lots of 3 pigs each, averaging 65 lbs. each in weight. The gain on corn and shorts 1:2 was 61 lbs., and on corn and alfalfa 1:2, 19 lbs. On each of the rations made up of grain, alfalfa hay, and swill there was a loss

of 3 lbs. "The alfalfa rations for young growing pigs were lamentable failures. The pigs grew scrawny and lost weight."

Supplements to corn for fattening hogs, E. B. FORBES (*Missouri Sta. Bul. 67, pp. 19*).—Using 15 lots of 4 or 5 pigs each concentrated feeds in varying proportions and combinations were compared as supplements to corn meal for dry-lot fattening. Ear corn was also compared with corn meal, both being fed with linseed oil cake.

The tests were made in the winter and covered 29 to 90 days, being preceded by preliminary periods of 4 to 6 weeks. The pigs were confined in small pens with a shed, but were not protected from wind and cold. The grains were ground and mixed to a slop with water except in the comparison of ear corn and ground corn.

When corn meal was supplemented by wheat middlings and linseed meal with and without germ oil meal and gluten meal and feed for 90 days, the gain ranged from 0.971 lb. per head per day on corn meal and wheat middlings 2:1 to 1.430 lbs. on corn meal and linseed meal 5:1, and the grain eaten per pound of gain from 4.45 lbs. on the latter ration to 5.18 lbs. on the former.

When linseed meal and wheat middlings were compared in varying proportions as supplements to corn meal in short periods (29 to 45 days) both the smallest and greatest gains, 1.269 and 1.776 lbs. per head per day, were noted with lots fed corn meal and linseed meal 5:1. The grain required per pound of gain was least with one of these lots being 3.85 lbs. and greatest, 4.75 lbs., with a lot fed corn meal and wheat middlings 2:1.

"The rations of linseed oil meal and corn meal in proportion of 1:5 were eaten in larger quantity than any other feeds tested and made more pork with smaller expenditure of feed than any other ration involved."

The estimated cost of pork made from the oil-meal rations averaged 11.3 per cent less than from the rations of corn meal and wheat middlings.

"Of the three corn products, gluten feed, gluten meal and germ oil meal, the first mentioned seems to be more useful than the others when fed with corn and linseed oil meal. None of them, however, in this combination are as useful as linseed oil meal by itself.

"Gluten meal is richer than gluten feed, differing from it only in lacking the corn bran with which it is ground to make the latter, but it does not seem to be as useful a supplement to corn and oil meal. The ration containing it was not so well relished and was not so efficient. It is possible that the usual recommendation that gluten meal be soaked before feeding to hogs would, if followed, have rendered it more valuable in comparison with gluten feed than it was in this experiment where it was fed immediately after wetting."

In 3 of the tests a mixture of corn meal and cotton-seed meal 8:1 was fed for 51 days. Cotton-seed meal fresh from the factory was fermented at living room temperature for 24 hours previous to feeding, sour milk being used as a starter. It was hoped that this fermentation would render the meal less toxic than it is reputed to be. The cotton-seed meal ration was mixed to a thinner slop than the other rations as it has been claimed that this is a desirable practice. The average daily gain per pig was 0.966 lb. and the grain eaten per pound of gain 4.97 lbs. Three of the 15 pigs included in these tests died at the end of the feeding period. "The gains up to that time had been moderate in extent and cost. The hogs did not relish this feed. A change to the corn and linseed oil meal ration induced much greater consumption of grain, increased the gains in weight 39 per cent and reduced the grain requirement per pound of increase to the extent of 13.1 per cent."

When ear corn and linseed cake 6:1 were compared with corn meal and linseed cake 5:1, the average daily gain per pig on ear corn during the 61 days of the test was 1.004 lbs. and the grain eaten per pound of gain 6.65 lbs. Similar values for the corn meal ration were 1.291 lbs. and 6.05 lbs.

Corn meal and oil cake "fed dry and mixed produced gains in weight with 9 per cent less grain than did ear corn and oil cake fed separately, both dry. The gain in the corn meal lot was 28.6 per cent greater than in the ear corn lot. The hogs receiving ear corn would not eat more than one-sixth as much oil cake as corn (the cob figured out) when both were allowed ad libitum."

In the opinion of the author the severity of the weather had an unfavorable effect on the gains made. The subject is discussed and data summarized regarding the influence of temperature on gains, indicating "that extreme heat of summer and extreme cold of winter act alike to the extent that they both occasion large energy expenditure on the part of the animal, in one case to keep warm, in the other to keep cool; and in either case occasion a great reduction in the profit from feeding in the dry lot when compared with results obtained in spring and fall. These results, however, do not apply to the feeding of hogs on pasture."

The poultry industry in Tasmania, R. J. TERRY (*Agr. and Stock Dept. Tasmania, Bul. 7, pp. 15, figs. 4*).—Various questions connected with profitable poultry raising under local conditions are discussed and some experimental data on fattening poultry are briefly reported.

DAIRY FARMING—DAIRYING—AGROTECHNY.

Profitable dairying, C. L. PECK (*New York: Orange Judd Co., 1906, pp. XII+174, figs. 34*).—This is offered as "a practical guide to successful dairy management," and consists of 23 chapters in which are discussed the physiology of milk secretion, dairy breeds, feeding cows, milking, care of milk, butter making, and similar topics.

Breed, individuality, and heredity in the production of milk, M. FISCHER (*Landw. Jahrb., 35 (1906), No. 3, pp. 333-379, pls. 3*).—A study was made of the yield and composition of the milk with particular reference to the casein of 12 cows representing 6 different breeds, and also of 10 cows selected from a large herd with a view to showing the influence of individual characteristics and heredity.

The milk of the mountain breeds including the Brown Swiss and Simmental showed a higher percentage of fat, casein, and solids-not-fat than that of the lowland breeds including the Oldenburg, East Fresian, Angler, and Wilstermarsch. The average annual yield of the latter group, however, was greater, making the annual yield of fat and casein of the 2 groups practically the same. In producing milk for cheese making the Brown Swiss breed is considered especially valuable as compared with the other breeds mentioned.

Within the same breed the author finds in casein production as in fat production marked individual variations. The transmission of individual characteristics is discussed at some length.

A test of a fly repellent, C. H. ECKLES (*Missouri Sta. Bul. 68, pp. 35-39*).—The entire dairy herd was sprayed with a fly repellent each morning during alternate periods of 2 weeks each. The test was continued during the entire summer of 1903 and for 6 weeks in the summer of 1904. The yields of milk and fat during the periods when sprayed and when not sprayed are tabulated and show no important effects either upon the yield of milk or fat due to the use of the fly repellent. When applied every morning the material used was fairly effective in protecting the cows from flies, but the claim made that the material will protect cows if applied at intervals of several days is considered erroneous.

Milking machines, P. G. WICKEN (*Jour. Dept. Agr. West. Aust., 13 (1906), No. 4, pp. 301-303, pls. 2*).—This is a summary of a report on the use of milking machines in Western Australia, the author concluding that the Lawrence-Kennedy-Gillies machine is now beyond the experimental stage and is working in hundreds of places daily giving practical results.

The composition of milk, H. D. RICHMOND (*Analyst, 31 (1906), No. 363, pp. 176-180*).—The average composition of 14,828 samples of milk analyzed during 1905

was as follows: Specific gravity, 1.0323; total solids, 12.70 per cent; fat, 3.73 per cent; and solids-not-fat, 8.97 per cent. The average fat content of the morning milk was 3.54 per cent and of the evening milk 3.91 per cent.

Analyses are also reported of 1 sample each of human milk, ass's milk, adulterated cream, a butter adulterant, and a new preservative. The butter adulterant consisted mainly of casein and the new preservative was acid potassium fluorid.

The milk supply of Boston, New York, and Philadelphia, G. M. WHITAKER (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 81, pp. 62, figs. 4*).—In this account of the milk supply of each of the cities mentioned information is given on the magnitude of the business, source of the milk, means of transportation, freight rates, handling the milk in the city, sanitary regulations, and similar topics. Maps are given showing the source of the milk supply of each of the cities.

On the influence of milk control upon the composition of milk in Gratz, K. HELLE (*Arch. Hyg., 56 (1906), No. 1-2, pp. 205-207*).—Under the influence of milk control the average fat content of the market milk of this city increased from 2.6 per cent in 1898 to 3.54 per cent in 1905.

The rapidity of the absorption of odors by milk, F. BORDAS and TOUPLAIN (*Compt. Rend. Acad. Sci. [Paris], 142 (1906), No. 22, pp. 1204, 1205*).—Milk exposed for several minutes in an atmosphere containing formaldehyde in the proportion of 1:100,000 showed clearly a reaction for this substance. The fresher the milk the more rapid was the absorption.

Contribution to the study of the bacterial content of milk and of the udder, R. D'HEIL (*Arb. Hyg. Inst. K. Tierärztl. Hochschule Berlin, 1906, No. 7; abs. in Rev. Gén. Lait, 5 (1906), No. 13, p. 306*).—The author finds bacteria regularly present in the milk cistern and ducts and concludes that they gain entrance through the orifice of the teat. Glandular tissue which contains only a small number of bacteria is believed to possess considerable bactericidal power. The higher bacterial content of machine-drawn milk is considered due to the difficulty of cleansing milking machines.

The contamination of milk at the dairy, A. H. STEWART (*Amer. Med., n. ser., 1 (1906), No. 1, pp. 17-21, figs. 9*).—Six experiments are reported which show in a striking manner the value of sterile covered milk pails in lessening the bacterial contamination of milk.

On the frequency of streptococci in milk, M. KAISER (*Arch. Hyg., 56 (1906), No. 1-2, pp. 51-89*).—Streptococci were found in 76.6 per cent of 30 samples of milk collected in Gratz and vicinity from November, 1904, to July, 1905. The cultural tests are reported in detail.

On the streptococci of milk, P. T. MÜLLER (*Arch. Hyg., 56 (1906), No. 1-2, pp. 90-107*).—Twenty-one cultures of streptococci isolated from pathological products and 22 from milk samples were studied as regards their power of coagulating milk, hemolytic properties, and behavior toward agglutinating serum.

It was found that nearly all of the milk streptococci curdled milk at the end of 24 hours, while very few of the pathogenic streptococci curdled the samples even at the end of 48 hours. All samples in both series, however, were curdled in 72 hours. The more rapid production of acid by the milk streptococci, however, is not considered as showing any specific difference between the two groups of organisms.

In studying the hemolytic power of the various organisms the cultures were divided into 2 series, the first containing those recently isolated, and the second those grown for some weeks in the laboratory. Of the 13 pathogenic streptococci in the first series 7 showed hemolytic properties, and of 10 in the second series 4 were distinctly and 1 slightly hemolytic. Of 10 milk streptococci in each series, 5 in the first and 3 in the second possessed hemolytic properties. The results, therefore, showed no striking difference between the pathological and milk streptococci as regards hemolysis.

In the agglutination tests 7 out of 11 milk streptococci reacted with an immune serum in a dilution of 1:10, while 2 reacted in a dilution of 1:400. Eight out of 9 streptococci of the pathogenic group gave a positive reaction in a dilution of 1:10 and 4 in a dilution of 1:400. The results are interpreted as showing a close relationship between some of the milk streptococci and pathogenic forms, and this was emphasized by the fact that the milk streptococci which reacted with immune serum in high dilutions were the forms which produced hemolysins.

The author, therefore, concludes from the results of his own and other investigations, which are cited, that there can no longer be any doubt that pathogenic streptococci are present in milk. How frequently these are present is a question yet to be answered.

The reduction test as a means of determining the freshness of milk, P. T. Müller (*Arch. Hyg., 56 (1906), No. 1-2, pp. 108-204, figs. 5*).—In making this test in laboratory work the author uses 4 test tubes, in one of which is put 2 cc. of whole milk and in the others equal quantities of milk diluted with water in the proportion 1:2, 1:4, and 1:8. To each tube is added 0.2 cc. of a 0.2 per cent solution of methylene blue, and the liquid after mixing is covered with a layer of liquid paraffin about 2 cm. in thickness. The samples are then placed in a thermostat at 37° C. and the time required for the reduction of the methylene blue in the whole milk is observed.

This test was applied to numerous samples of market milk showing different degrees of acidity; mixtures of fresh and sour milk; dirty milk; milk to which soda, boric acid, salicylic acid, formaldehyde, and hydrogen peroxid had been added; and heated milk.

For fresh milk obtained in a cleanly manner the time required for the reduction of the methylene blue was 10 or more hours, and for milk delivered by producers directly to consumers during cold weather 6½ to 9 hours. The reduction test of milk obtained from small dealers during the forenoons was 5 to 6 hours during cold weather and 1 to 2¾ hours during warm weather, while that of the samples obtained during the afternoons was ¾ to 3 hours during cold weather and ⅓ to 1 hour during warm weather. Milk kept at a high temperature showed a shorter reducing period than milk kept at a low temperature.

Curdled milk reduced the methylene blue in a few minutes. The addition of small quantities of sour milk and also of manure to fresh milk shortened greatly the reducing period. The neutralization of milk with soda was without influence on its reducing properties, but the addition of soda to milk poor in bacteria lessened the time required for reduction until sufficient acid was produced to render the milk again neutral or acid.

The addition of preservatives such as boric acid, salicylic acid, and formaldehyde lessened or destroyed the reducing power of the milk. Milk heated for 15 to 30 minutes at 100° C. showed only a small reducing power, which, however, gradually increased the longer it was kept.

The author describes a modified form of the laboratory method which he considers suitable for household use in determining the freshness of milk. When reduction does not occur at the end of 1 hour the milk is considered suitable for infant feeding.

The testing of market milk, A. Lam (*Chem. Ztg., 30 (1906), No. 39, p. 467*).—This is an abstract of a paper presented before the Sixth International Congress of Applied Chemistry.

In testing market milk in regard to its sanitary condition the author determines what he calls the catalase number. Ten cc. of milk is treated with 5 cc. of a 1-per cent solution of hydrogen peroxid and allowed to stand for 24 hours at a temperature of 22 to 35° C. The number of cubic centimeters of oxygen gas liberated is designated the catalase number. For fresh pure milk this varies between 0.3 and 1. In cases of mastitis or tuberculosis of the udder this number is found to be increased. Milk showing a catalase number of over 3 is considered unfit for use.

The author has also found polarization of the milk serum of value for this purpose. While the normal index of refraction lies between 5 and 5.5, it was found to be 1.2, 1, and 0.73 in the case of diseased animals. The freezing point, however, remained constant.

The care of composite milk samples, I. C. WELD (*New Hampshire Sta. Bul. 126, pp. 181–184, figs. 5*).—Brief notes are given on the taking of composite milk samples and on preserving them with formalin, potassium bichromate, or corrosive sublimate.

On the combination of lactic acid with casein in lactic fermentation, C. RICHET (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 14, pp. 650, 651*).—When milk was allowed to coagulate spontaneously the curd was found to fix about 5 times the amount of lactic acid contained in the same volume of whey.

A test of tin can separators, C. H. ECKLES (*Missouri Sta. Bul. 68, pp. 23–34, figs. 4*).—Tests were made of 3 forms of so-called separators which consist of 2 cans one within the other. The milk is placed in the inner can and cold water in the outer can surrounding the milk.

The average results of 42 trials with these cans showed that the skim milk contained 1.39 per cent of fat, equivalent to a loss of 22.56 per cent of the fat. The 3 patented cans were compared with shallow pans, a dilution can, the centrifugal separator, and a homemade can. Under the conditions of the comparison the shallow pans gave better results than either the dilution or double cans. The homemade can costing $1.50 gave equally good results as the patented cans costing from $6 to $10.

Creamery problems, C. L. BEACH (*Connecticut Storrs Sta. Bul. 40, pp. 38–47*).—Of 1,362 patrons of 18 creameries in 1903, 256, or 19 per cent, were using centrifugal separators, while the remainder were using the Cooley system of cream raising. Comparative tests were made of these 2 methods.

The average of 13 samples of skim milk by the Cooley system showed the presence of 0.27 per cent of fat, and the average of 36 samples of separator skim milk showed the presence of 0.056 per cent. It is estimated that with a herd of 10 cows the hand separator effects a saving of $25.48. Five types of centrifugal separators were compared, the fat content of the skim milk ranging from 0.038 to 0.076, which difference for a herd of 28 cows is estimated as equivalent to $7.95 for one year.

The fat content of 10 samples of skim milk was determined by gravimetric analysis and by the Babcock test, using 17.6 cc. and 25 cc. of acid. The average results for the 3 methods were, respectively, 0.144, 0.046, and 0.063 per cent. Even with the excess of acid the Babcock readings were much lower than the gravimetric determinations.

Readings of Babcock tests were made at temperatures of 130 and 180° F., the average difference on 10 samples being 0.42 per cent. This emphasizes the importance of making the readings at a uniform temperature.

Variations in the weight of 18 cc. of cream containing different percentages of fat are given in tabular form to show the importance of weighing samples.

In 14 experiments a starter made from a pure culture was compared with a skim milk starter. The average score of the butter from the 14 churnings when the pure culture starters were used was 94 and of the butter from the churnings ripened with skim milk starters 94.1. A table shows the bacterial content of 12 samples of butter, of the cream from which the butter was made, and of the starter used in ripening the cream.

Creamery cold storage, J. A. RUDDICK (*Canada Dept. Agr., Dairy Comr. Branch Bul. 10, pp. 14, pls. 2*).—This furnishes information on the subject of creamery cold storage and embodies the results of recent experiments conducted for the purpose of testing various materials used for the purpose of insulation. Specifications are given

for the construction of creamery refrigerators on both the air circulation and cylinder systems.

The manufacture of whey butter at Swiss cheese factories, E. H. FARRINGTON (*Wisconsin Sta. Bul. 132, pp. 32, figs. 17*).—This bulletin, which is published in both English and German, contains descriptions of the methods employed in making whey butter in Swiss cheese factories in Wisconsin, with suggestions for the improvement of these methods.

The cold process of skimming the whey is considered not only wasteful but unsatisfactory on account of the extremely sour condition in which the whey is returned to the farmers, and also because the cream so obtained is not suitable for the manufacture of good butter. It is believed that this method should be abandoned. The hot process is considered much superior to cold skimming in that much more fat is recovered and the cream is in a sweet condition, making it possible to produce butter of good flavor.

About 2 years ago some experiments were made at the University of Wisconsin dairy school in skimming whey with a centrifugal power separator, and since then this method has been tried on a practical scale in a number of factories. According to the author's observations centrifugal separation is much superior to the other methods. The separator removes nearly all of the fat and permits the making of butter equal in quality and water content to creamery butter. The objections made to installing separators in cheese factories are their cost and the expense for power. Results have shown, however, that with improved methods of skimming and churning the surplus whey butter may more than pay for the additional cost.

In addition to the separator there is needed in the Swiss cheese factories, according to the author, a cream vat of some sort in which the whey cream may be ripened and cooled before churning and improved methods of working the butter.

The suggestions made for improving whey butter cover skimming the whey, ripening the cream, making and using a starter, churning the cream, working the butter, and other topics.

Some facts about moisture and its effects on butter, G. L. McKAY (*Hoard's Dairyman, 37 (1906), No. 16, pp. 432, 433*).—In discussing this subject the author gives data obtained at the Iowa station and observations made abroad.

It is not believed that the poor keeping quality of butter is due to an excess of moisture so much as to unsanitary methods pursued and the use of overripe cream. The author considers that "there is no danger of any maker incorporating too much water who churns his butter in a granular condition and does not resort to abnormal methods, such as churning at high temperatures, washing with warm water, overchurning, or working the butter in water."

On the composition of Dutch butter made in the creameries placed under State control, T. VAN SILLEVOLDT (*Gen. Dir. Agr. Min. Agr., Indus. and Trade [Netherlands], [Circ.], 1905, No. 5, pp. 31; 1906, Jan., Feb., Mar., Apr., pp. 4 each*).—Of 4,340 samples of butter analyzed during October, November, and December, 1905, 78 showed a lower Reichert-Meissl number than 24. The analytical results are hereafter to be published monthly, with a special report every 6 months on the samples showing low Reichert-Meissl numbers.

Bacteriological examinations of the butter of Stuttgart, A. REITZ (*Arch. Hyg., 57 (1906), No. 1, pp. 1-28, figs. 5*).—This is a detailed report of the inoculation experiments with guinea pigs made to determine the presence of tubercle bacilli in butter, previously noted from another source (E. S. R., 17, p. 1109). Tubercle bacilli were present in 8.5 per cent of the samples.

Fungi in cheese ripening: Camembert and Roquefort, C. THOM (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 82, pp. 39, figs. 3*).—This reports in detail the mycological studies referred to in the previous bulletin (E. S. R., 17, p. 79) on the manufacture of Camembert cheese in the United States.

In the manufacture of soft cheese of the Camembert type the curd is rendered acid by the action of lactic-acid bacteria, and later alkaline by the growth of various species of fungi which, through the production of enzyms, break down the curd to a greater or less extent.

"The Camembert Penicillium (*P. camemberti*) is the only species so far studied with which the particular appearance and texture sought in the ripened Camembert can be produced from curd soured by lactic bacteria without producing any objectionable flavor.

"*Oidium lactis* is always found upon Camembert cheese and so closely associated with the presence of the flavor as to indicate its agency in flavor production, though only circumstantial proof of such function has been possible thus far. The participation of bacteria in flavor production is not excluded by these results.

"Other species of fungi have been shown to produce variations in this flavor such as have been often found in certain market cheeses."

The Roquefort Penicillium (*P. roqueforti*) is the only fungus found necessary to produce the typical flavor of Roquefort cheese. This mold has also been found in imported Stilton, Gorgonzola, and Brinse cheese as well as in the Roquefort.

Oidium lactis is the only fungus which has been found regularly upon Limburger, American Brie, Isigny, and related types of cheese.

Technical descriptions are given of the 2 forms of Penicillium under the new names *P. camemberti* and *P. roqueforti* and of *Oidium lactis*.

A new method of making dry red wine, F. T. Bioletti (*California Sta. Bul. 177, pp. 36, figs. 14*).—Wine-making experiments during the year have abundantly verified, according to the author, the claims made for the method given in Bulletin 167 of the station (E. S. R., 17, p. 183).

"The most important conclusion to be drawn from these experiments is that sound dry wine of fair quality can be produced in the upper San Joaquin Valley and similar regions from the varieties of grapes growing there, simply by ordinary attention to cleanliness, the sterilization of cooperage, and more than ordinary attention to the control of temperature.

"For white wines a thorough preliminary defecation of the must by means of sulphur fumes and the use of pure yeast or yeast starters is advisable.

"For red wines some form of cooling machine is essential, and the temperature of the fermenting wine should never exceed 95° F., and if possible should be kept below 92° F. This can be easily and perfectly done by means of the cooling machine described in Bulletin No. 174 (E. S. R., 17, p. 1110).

"The grapes both for white and red wines should be thoroughly ripe. Ripeness must be determined by the flavor and appearance of the grapes more than by the amount of sugar they contain. We can not hope to get the best results from imperfectly ripe grapes even if they contain 22 per cent of sugar. Some varieties in the climate of the San Joaquin Valley are not perfectly mature for wine-making purposes until they contain 25 per cent of sugar or more. Better results are to be obtained by diluting and, if necessary, adding tartaric or citric acid to over-ripe grapes in this region than by attempting to make wine from under-ripe grapes which have not developed the color, body, and flavor necessary for the production of good wine."

The cost of applying this method on a large scale is yet to be ascertained, and with this in view a plan is given of a cellar suitable for working 50 tons of red grapes per day along with an outline of the method of operation.

The artificial ripening of grapes, L. Mathieu (*Rev. Vit., 25 (1906), No. 640, pp. 313–316*).—The results are given of an experiment in which wine was made from grapes partially dried in an evaporator. The work shows that it is possible to partially evaporate grapes in order to concentrate the must without any injurious effects or cooked taste to the wine. The process favors the production of a wine of superior quality.

VETERINARY MEDICINE.

Proceedings of the American Veterinary Medical Association (*Proc. Amer. Vet. Med. Assoc., 42 (1905), pp. 506, pls. 20*).—This volume contains an account of the meeting of the forty-second annual convention of the American Veterinary Medical Association, held in Cleveland, Ohio, August 15–18, 1905.

As usual, in the proceedings lists are given of the officers, committees, resident secretaries, and honorary and active members of the society. The address of welcome was given by the mayor of Cleveland, T. L. Johnson, and was responded to by R. R. Bell. The president's address, by M. E. Knowles, contained references to various veterinary matters, particularly to the cooperation of veterinarians and physicians and the importance of the veterinarian in the promotion of general sanitation.

In the reports of resident State secretaries attention is called to the condition of health in domesticated animals in the various States and Territories. In Arizona and New Mexico, particular attention was given during the year to sheep scab; in Colorado to cattle mange, loco weed, and bovine tuberculosis; in Connecticut, Cuba, and Porto Rico, to the legislative control of animal diseases; in Maine, to tuberculosis and glanders; in Maryland, to anthrax and forage poisoning; in Michigan, to rabies; in Minnesota, to hemorrhagic septicemia and swamp fever; in Mississippi, to anthrax and Texas fever; in Nebraska, to various parasitic diseases; in Ohio, to tuberculosis and swine plague; in Ontario, to actinobacillosis and hog cholera; in Pennsylvania, to legislation regarding experimental veterinary work; in the Philippines, to surra, rinderpest, and foot-and-mouth disease; in Tennessee, to glanders and influenza; in Texas, to Texas fever and cattle mange; in Vermont, to anthrax and glanders; and in Wisconsin, to the present status of the veterinary practitioner.

The Report of the Committee on Intelligence and Education, by C. J. Marshall et al., contains a general review of matters of interest to veterinarians, a digest of recent veterinary literature, and a detailed account of the quality of instruction and the curricula in various veterinary schools in this country.

In the report of the Committee on Diseases, by C. H. Higgins et al., attention is devoted to methods of keeping the clinical history of cases, the need of more veterinary research work, and the discussion of rabies, *Bacillus necrophorus*, roup in chickens, and the State control of tuberculosis. The present status of the movement for securing legislation regarding army veterinarians was presented by a committee consisting of W. H. Lowe et al.

An unusual number of papers were read at the various meetings of the convention and are printed in the proceedings. It is impossible to refer to these except in the briefest manner. The Artificial Immunization of Cattle Against Tuberculosis was discussed by L. Pearson and S. H. Gilliland. The authors report considerable success in the use of various vaccinating methods and believe that these methods promise to become much more effective. Papers were also presented on The Pathology of Tuberculosis, by C. Schulin, and by R. H. Harrison on Unusual Lesions of Tuberculosis Found in Abattoir Inspection. The method of controlling glanders adopted by a French firm which employs a large number of horses was discussed in a paper by E. Lavalard. The method consists in the general use of mallein, furnishing as favorable conditions as possible for suspected horses in quarantine, and the exercise of great care in introducing strange horses into a healthy herd.

The Spavin Group of Lamenesses was discussed by W. L. Williams et al. This account is one of the most important thus far published on the general subject of spavin and enters, in great detail, into the pathology, peculiar forms, etiology, and treatment of the disease by different methods.

Mention should also be made of the following papers: The Clinical Examination of the Blood of the Dog, by S. H. Burnett and J. Traum; Cultivation of *Trypanosoma equiperdum*, by J. R. Mohler; Twenty-seven Years' Experience in Veterinary Practice, by J. V. Newton; Accidents and Sequelæ of Surgical Operations, by L. A. Merillat; Indications for Neurectomies of the Pelvic Limb of the Horse, by R. C. Moore; The Profession and the Advancement of Science, by D. A. Hughes; Stable Ventilation, by M. H. Reynolds; The Status of Therapeutics, by P. A. Fish; A Review and Criticism of the Eighth Decennial Revision of the Pharmacopœia of the United States, by E. L. Quitman; Hydrothorax in the Horse, by G. B. Jones; and A New Treatment for Gastro-Intestinal Catarrh of Milk-Fed Calves, by L. A. Klein.

Annual report of the State board of live stock commissioners of Ohio, P. FISCHER (*Ann. Rpt. Bd. Live Stock Comrs. Ohio, 4 (1905), pp. 71, figs. 14*).—The diseases which have occurred in Ohio to an extent which attracted the attention of the live stock board during the past 4 years included the most important diseases of horses, cattle, sheep, hogs, cats, and fowls.

The work of the board of the live stock commissioners has extended in many directions, until at present it is considered that the services of additional veterinarians are needed. As usual in these reports maps are given showing the location of anthrax, actinomycosis, foot-rot, glanders, hog cholera, swine plague, keratitis, nodular disease, rabies, mange in horses, tuberculosis, and Texas fever. In the case of each one of these diseases a brief account is presented of the work of the State veterinarian and his assistants in controlling the outbreaks.

In an appendix to the report copies are given of laws relating to live stock and the duties of the board of live stock commissioners of Ohio.

Abstracts of work done in the laboratory of veterinary physiology and pharmacology, III, P. A. FISH ET AL. (*Ithaca: N. Y. State Vet. Col., 1906, pp. 44*).—An account is presented of a case of urethral calculus in the dog (pp. 3–8), arecolin hydrobromate and its action upon dogs and cats (pp. 9–13), the effects of sulphurous acid upon peptic and tryptic digestion (pp. 14–21), ergot as an abortifacient (pp. 22–29), the status of therapeutics (pp. 30–34), the structure and function of the digestive tract of the chicken (pp. 35–42), and the effect of sulphurous acid upon the urinary constituents (pp. 43, 44).

In experiments with ergot in which cats were used, it was found that doses of this drug would produce abortion within 24 hours. In some cases the young were killed, while in others they seemed not to be affected. It is concluded, therefore, that ergot exercises an abortifacient action of considerable power. Attention is called to the present status of theraputics as a profitable subject of study for veterinarians. New drugs are constantly being put on the market, and from the great number thus offered for use the veterinarian must select, as a result of experiment, those which really give promise of good results. Some of the new remedies are superior to the old ones used for specific purposes, while others are no better or quite inferior.

The Bang method of controlling tuberculosis with an illustration of its application, H. A. HARDING, G. A. SMITH, and V. A. MOORE (*New York State Sta. Bul. 277, pp. 81–109*).—A general account is presented of the nature of tuberculosis, together with a description of the Bang method of controlling the disease and the use of tuberculin.

In December, 1900, one animal in the station herd was found to be tuberculous and on this account the tuberculin test was given to the whole herd. As a result of the test a reaction was obtained with 8 cows and 7 young cattle in a total of 28. These animals were kept under observation, and in 1901 the Bang system was put in operation for the purpose of determining its value under the conditions which prevailed in the station herd.

The method was applied to a total of 30 animals, 13 of which were healthy and 17 tuberculous. During the 4 years of the test this herd produced 23 heifer calves,

one-half of them coming from the tuberculous animals. The calves obtained from the tuberculous cows were not allowed to suck their mothers nor to drink tuberculous milk until after it had been pasteurized at a temperature of 185° F. The record of the tuberculous part of the herd is given in a tabular form and notes are also presented on autopsies on diseased animals and an examination of the meat of tuberculous animals killed for beef.

A healthy herd from a tuberculous herd, F. H. HALL, H. A. HARDING, G. A. SMITH, and V. A. MOORE (*New York State Sta. Bul. 277, popular ed., pp. 8, fig. 1*).—A popular summary of Bulletin 277, noted on page 1189.

Combating tuberculosis in farm animals, A. VAN LEEUWEN (*Tijdschr. Veeartsenijk., 33 (1906), No. 6, pp. 340–345*).—This is a controversial article in which the author takes the position that a governmental requirement of notification of all cases of tuberculosis in domesticated animals would work great hardship. It is frequently impossible for the owner to determine when an animal is affected with the disease, in fact the most experienced veterinarians sometimes have to make use of all means of diagnosis in order to determine the matter.

Distribution of tuberculosis in suspected and nonsuspected herds in Wisconsin, H. L. RUSSELL and E. G. HASTINGS (*Wisconsin Sta. Bul. 133, pp. 15, figs. 3*).—On account of the insidious nature of tuberculosis and also on account of the fact that the disease has been found very prevalent in certain dairy herds the present bulletin has been prepared for the purpose of furnishing a concise description of the tuberculin test and further data regarding the results obtained from this test and its reliability.

Brief summaries are presented of some of the previous work done by this station on tuberculosis, and recommendations are made regarding the disinfection of stables. For this purpose the authors recommend a whitewash made of fresh unslaked lime, and also saturated solution of copperas.

Are tubercle bacilli coughed up by cattle affected with pulmonary tuberculosis? J. A. KLAUNERS (*Tijdschr. Veeartsenijk., 33 (1906), No. 6, pp. 351–353*).—From statistics regarding the organs affected in cases of bovine tuberculosis it appears that the lungs were diseased in 40,306 cases among a total of 46,092. On the basis of these facts and the further fact of the frequent infection of the lymphatic glands of the throat and pharynx, the author justifies the conclusion that tuberculosis in cattle is very frequently contracted by inhalation and that, therefore, the tubercle bacilli which cause such infection probably come from other cows affected with the pulmonary form of the disease.

Serum vaccination against anthrax, G. GAZZANIGA (*Clin. Vet. [Milan], 29 (1906), No. 8, pp. 203–205*).—Brief notes are given on vaccination for the purpose of preventing anthrax by the method which requires the use of two vaccines. This method has given satisfactory results in the author's hands.

Blackleg, W. H. DALRYMPLE (*Louisiana Stas. Bul. 85, pp. 7, fig. 1*).—Inquiries are frequently received at the station regarding the nature of blackleg and suitable treatment for this disease. It is suggested that probably many young scrub cattle of little value die of blackleg from year to year without any investigation of the cause of the disease. This fact may account for the persistence of the disease in certain localities. Notes are given on the cause, symptoms, treatment, and preventive vaccination for blackleg.

Vaccination against blackleg, K. R. KUIPERS (*Tijdschr. Veeartsenijk., 33 (1906), No. 6, pp. 345–351*).—Various methods were tried in vaccinating calves against blackleg. The author used vaccine thread, dried vaccine, and material in solution. The best results were obtained from the last-named method. Brief notes are given on the pathological anatomy of blackleg based on a number of autopsies.

Texas fever with methods for its prevention, J. R. MOHLER (*U. S. Dept. Agr., Bur. Anim. Indus. Bul. 78, pp. 48, pl. 1, figs. 3*).—The author presents a valuable

summary of information relating to the nature of Texas fever and the practical means of its eradication.

The subject-matter includes a definition of the disease; notes on its history and distribution; etiology; life history of the cattle tick and its agency in distributing Texas fever; means of distinguishing between this tick and other species of ticks; the loss caused by ticks aside from their agency in carrying Texas fever; symptoms, course, and termination of Texas fever; and treatment and prevention of the disease. Definite and practicable plans are presented for the arrangement of farms so that cattle may be freed from ticks and the ticks ultimately eradicated by the system of feed lots and pasture rotation. The method of immunization by means of the blood of recovered cattle is also described.

Vaccination against foot-and-mouth disease, N. L. Buonsanti (*Clin. Vet.* [*Milan*], *29* (*1906*), *No. 6, pp. 145–148*).—Numerous experiments have been carried out in vaccinating cattle against foot-and-mouth disease by means of a mixture of 0.03 cc. of virulent lymph and 0.5 cc. of bovine serum. For vaccinating hogs and sheep the author has used a concentrated serum from a horse previously inoculated with the virus. The results thus far obtained are promising.

The treatment of epizootic abortion, E. Thierry (*Jour. Agr. Prat., n. ser., 11* (*1906*), *No. 7, pp. 208, 209*).—A number of investigators have found that good results may be obtained from the use of antiseptic solutions, such as the use of corrosive sublimate, 1:1,000 parts in water, and a solution of iodin and iodid of potash. An internal prophylactic treatment, with doses of 5 to 6 drams of iodid of potash, has also given satisfactory results.

The poisoning of cattle by tobacco decoction, F. Peuch (*Jour. Méd. Vét. et Zootech., 57* (*1906*), *Feb., pp. 78, 79*).—Two heifers which had become greatly infested with fleas were treated by the owner with tobacco decoction as obtained from the manufacturer and diluted with an equal amount of water. Within a few hours serious symptoms of poisoning occurred, the animals being unable to rise and in a state of extreme coma. Considerable irritation of the skin was also produced. Recovery took place on the following day.

Attention is called by the author to the fact that tobacco decoction, diluted with 10 parts of water, is effective in such cases and ordinarily does not produce poisonous effects.

Vaccination for hog cholera, L. Brusasco (*Gior. R. Soc. ed Accad. Vet. Ital., 55* (*1906*), *No. 6, pp. 123–125*).—References are made to some of the more important publications on this subject and a table is given showing the results of vaccination against hog cholera during 1905. From this table it appears that the percentage of mortality in nonvaccinated hogs was 79.6, while in vaccinated animals it was 17.4.

Combating swine plague, Foth (*Berlin. Tierärztl. Wchnschr., 1906, No. 7, pp. 115–123*).—From the standpoint of the veterinary police, swine plague includes hog cholera as well as swine plague proper.

Although these diseases frequently occur simultaneously in the same animal, the official veterinary police must depend largely upon the clinical symptoms and the infectiousness of the disease in reaching a diagnosis. The persistent spread of swine plague is attributed to its already wide distribution, the chronic course of many cases, the aversion to strict quarantine, traffic in live pigs, too early period of weaning pigs, neglect of hygienic precautions, and the extensive use of improved breeds, some of which are less resistant than grade hogs.

Antidotes for poisoning by Gastrolobium calycinum, E. A. Mann (*Jour. Dept. Agr. West. Aust., 13* (*1906*), *No. 1, pp. 50, 51*).—Feeding experiments were carried out with this plant in the case of sheep in order to test various antidotes for the alkaloid poison in the plant. Permanganate of potash in acidulated water appeared to have no influence in checking the poisonous effects. Negative results were also

obtained with sodium bicarbonate. The action of tannic acid, however, when given as a drench in doses of ½ oz. appeared to be quite satisfactory.

Suggestions as to dipping sheep (*Jour. Bd. Agr.* [*London*], *12* (*1906*), *No. 11*, *pp. 678-681*).—Directions are given for cleaning dipping tanks and catching pens, mixing dips, trimming the wool, and related matters, together with notes on the proper time of dipping and on the repetition of the process.

Infectious broncho-pneumonia of lambs, E. THIERRY (*Jour. Agr. Prat., n. ser.*, *11* (*1906*), *No. 4*, *pp. 110-112*).—Opportunity was had for studying a rather serious outbreak of pleuro-pneumonia of lambs. As a result of this study it appears that the disease is of bacterial origin, although the micro-organism was not isolated. In controlling the disease the usual procedure in cases of infections is recommended, viz, isolation of diseased animals and thorough disinfection.

Further notes on the pathogenic organism of pneumonia and its biology, LORENZ (*Berlin. Tierärztl. Wchnschr.*, *1906*, *No. 9*, *pp. 145-147*, *figs. 3*).—As reported in previous articles by the author, an organism was found in the skin of horses affected with pneumonia several days after recovery.

This organism was obtained under the observation of the strictest rules of asepsis and proved to be a streptococcus when cultivated on artificial nutrient media. The streptococcus appears to develop from minute rods. This organism when used in inoculation reproduces the disease. The author believes as a result of a further study of this organism that it is really a plasmodium or sporozoan, which may be observed in various forms, such as spores and rods, which may unite to form streptococcus.

The demonstration of the organism of pneumonia in horses and its biology, LORENZ (*Berlin. Tierärztl. Wchnschr.*, *1906*, *No. 7*, *pp. 113-115*, *figs. 8*).—On account of the irregular manner in which an outbreak of pneumonia usually progresses in a herd of horses it has been assumed by many investigators that the organism of this disease must require an intermediate host, and in this connection flies have been suggested.

The author finds, however, that the organism persists for a long time in the subcutaneous tissue. It has been found in considerable numbers in such locations and kept in pure cultures. When the virus thus obtained was inoculated into rabbits, cocci were found in the blood 20 hours after inoculation. Since the organism described by the author appears to be the true cause of pneumonia, it is believed that a method of vaccination can now be readily devised which will protect animals against the disease.

Pleuro-pneumonia, MOUQUET (*Bul. Soc. Cent. Méd. Vét.*, *83* (*1906*), *No. 4*, *pp. 114-117*).—Notes are given on the symptoms of pleuro-pneumonia in horses in which septic edema occurred and an ammoniacal fermentation in the thoracic cavity. A study was made of the reaction and chemical properties of the serous fluid in the pleural cavity and the gases developed by the ammoniacal fermentation in this fluid were studied.

Experiments with contagious coryza, with especial reference to the immunization of rabbits against this disease, J. LUDWIG (*Monatsh. Prakt. Tierheilk.*, *17* (*1906*), *No. 7-8*, *pp. 289-321*).—The literature on this disease is critically reviewed in connection with a short bibliography.

It appears from experimental work carried out by the author that rabbits may be actively immunized against contagious coryza. A number of methods are successful in accomplishing this result, but the best seems to be found in the use of cultures killed by means of heat or by the use of iodin trichlorid. The active immunization may be brought about rapidly and may be carried to a high degree by repeated inoculations. The organism of contagious coryza is practically nonvirulent for rabbits when inoculated hypodermically, but in intraperitoneal injections it rapidly produces death. From the blood of rabbits thus immunized a serum may be obtained which will protect other animals from infection.

Experiments in protective inoculation against contagious coryza with dead streptococci, T. KITT (*Monatsh. Prakt. Tierheilk., 17 (1906), No. 7-8, pp. 363-367*).—The experiments reported in this paper were carried out on colts. It was found possible to immunize colts to a considerable extent by inoculating them with dead cultures of the streptococcus of contagious coryza. The method, however, has little to recommend it in actual practice, since in order to obtain a protective immunity 6 or 7 treatments must be given. Passive immunity which may be produced by means of injections of serum has only a short duration.

Kimberley disease in horses, R. E. WEIR ET AL. (*Jour. Dept. Agr. West. Aust., 12 (1905), No. 1, pp. 60-63*).—This disease has a course of variable duration and is characterized by symptoms of congestion and derangement of the brain.

It appears that the extraordinary mortality which occurs from attacks of this disease can not be attributed solely to one cause. The presence of parasites, however, particularly *Spiroptera megastoma*, may be looked upon as a predisposing cause, in connection with coarse forage and the ingestion of large quantities of green food. In treating the disease the author recommends antipyrin 3 times daily in doses of 1 dram together with a mixture containing ½ dram calomel and ½ oz. ginger.

A skin disease in horses affecting only the white markings, E. E. MARTIN (*Vet. Rec., 18 (1906), No. 922, pp. 628, 629*).—In Calcutta the author observed a number of cases of skin disease in Australian horses which had just been landed. The white parts only were affected and appeared as if blistered. The disease was attributed to an attack of insects, but the exact species was not known.

Osteomalacia in Tonquin, J. SOURREL (*Rev. Gén. Méd. Vét., 7 (1906), No. 77, pp. 233-248, figs. 3*).—During the years 1901-1904 the author had occasion to study osteomalacia in horses and mules in Tonquin.

It was found that the disease appears after a varying period following upon exposure or introduction to an affected region. The usual period ranges from 6 months to 2 years. Animals first appear lame and depressed, later malformations may appear particularly in the form of enlargements of the flat bones and short articular bones. Fractures of the long bones in the leg may occur at any time during the course of the disease. Ultimately the stage of extreme cachexia results, so that prognosis is always serious.

It was found that osteomalacia occurs in regions where there is plenty of lime in the soil and in the forage plants as shown by analysis. The absence of lime could, therefore, not have been the cause in the cases observed by the author. It is believed that the disease is of infectious origin, but the organism has not been isolated. Therapeutic treatment is not very successful, but some benefit was derived from the use of pilocarpin, purgatives, strychnin, and feeding green forage plants, for which purpose the author recommends the use of *Panicum æquinum*.

Use of artificial impregnator in horse breeding, L. L. LEWIS and W. L. ENGLISH (*Oklahoma Sta. Circ. 5, pp. 8, figs. 6*).—The importance and general use of the artificial impregnator by stockmen led the station to send out a circular letter of inquiry regarding the methods in common practice.

It appears that there are two forms of impregnator in general use, the straight and the curved. The latter is preferred, and may be used with or without a vaginal speculum. If a breeding bag is used on the stallion a speculum will be found unnecessary. Before service it may be well to close the neck of the uterus with a rubber plug. After service the plug is removed at once, a part of the semen injected into the uterus and the rest used to impregnate other mares. Before transferring the semen the syringe should be warmed in water at a temperature of 100° F. and the transfer should take place without delay.

Experiments in preserving semen in vials for a period of 3 hours or more showed that a temperature of 100-103° F. is less favorable to the vitality of the spermatozoa than 85° F. In Oklahoma the breeding bag is used by about two-thirds of those who

impregnate mares artificially. As was to be expected, better success attends the efforts of the breeder the longer he practices the method.

The effect of experimental epilepsy on poisoning by tetanus toxin, L. CESARI (*Compt. Rend. Soc. Biol.* [*Paris*], *60* (*1906*), *No. 8, pp. 397–399*).—It has been claimed by a few investigators that the effects of tetanus toxin may be somewhat overcome by passing an alternating electro-current through affected animals.

This was tested on guinea pigs by the author with the result that little benefit was found from the practice. Guinea pigs inoculated with tetanus toxin showed the epileptiform crisis of the disease during the passage of an alternating current in the same manner as shown by normal animals. The muscular contractions disappeared for a few minutes after the epileptiform crisis but soon recurred again. Animals treated in this manner lived little longer than the control animals.

Treatment of demodectic mange, CEDÉAC (*Jour. Méd. Vét. et Zootech.*, *57* (*1906*), *Feb., pp. 80–83*).—Attention is called to the undesirability of attempting to treat all forms of mange and parasitic skin diseases by similar lines of treatment. In some forms of mange caused by demodectes as well as phlegmenous dermatitis it is usually best to scarify the affected parts and apply tincture of iodin.

The bacillus of mouse typhoid and related forms, R. TROMMSDORF (*Arch. Hyg.*, *55* (*1906*), *No. 3, pp. 279–298*).—An attempt was made to determine the relationship and independence or identity of various bacteria related to the mouse typhoid bacillus.

In experiments along this line a series of agglutination tests were made, but it was found that agglutination is a very uncertain method of determining the identity or specific individuality of bacteria of this group. Apparently *Bacillus enteritidis* is distinct from the other bacteria of this group, while there are various groups under the paratyphoid bacillus as well as of the hog cholera bacillus. It was impossible by means of agglutination tests to differentiate between the mouse typhoid bacillus, hog cholera, paratyphoid, and meat-poisoning bacillus.

Attention is called to the fact that the bacilli which have been used for the destruction of mice as well as the hog cholera bacillus may be pathogenic for man. The author believes, however, that there is no justification for prohibiting the use of cultures of mouse typhoid bacillus in the destruction of field mice.

RURAL ENGINEERING.

Irrigation from Snake River, Idaho, H. G. RASCHBACHER (*U. S. Dept. Agr., Office Expt. Stas. Circ. 65, pp. 16*).—The territory covered by this circular extends from the Wyoming line to Salmon River, a distance of about 200 miles. In this area there is about 800,000 acres at present under ditch, and the proposed works will cover about 200,000 acres additional. Probably not more than half of this land is at present under cultivation, leaving a large area which is awaiting settlement.

This circular is devoted to the conditions which a new settler will meet in making a home in this section. With few unimportant exceptions, the settlers must secure rights from companies building ditches, there being little if any opportunity for securing rights directly from the streams. Most of the canals are built either under the Carey Act, under which the lands and water rights are disposed of on terms specified in contracts with the State, or under the reclamation act, which provides for the payment by the settler of the actual cost of the construction of the works, the lands being taken up under the homestead law, which requires the payment of land office fees only.

The prices of water rights under these various projects vary from $15 to $25 per acre. The expense which must be met by the new settler during the first year is estimated as follows, the full price of the water right being included in this estimate.

This, however, need not be paid during the first year, but may be distributed over a series of years.

First cost of the land and water right	$25.50
Fencing material	3.00
Labor:	
Grubbing sagebrush	3.50
Plowing	2.50
Seeding	.50
Leveling and marking	1.00
Ditching	2.00
Irrigating	2.00
Total cost per acre	40.00

The circular contains also the record of a number of crop experiments made at Twin Falls during the season of 1905.

Results of experiments on irrigated meadows, TACKE (*Mitt. Deut. Landw. Gesell., 21 (1906), No. 9, pp. 96–101*).—The experiments described were started in 1900 on meadow lands belonging to the agricultural improvement association of Bruchhausen-Syke-Thedinghausen.

Three types of soil were selected, a clayey loam meadow with a layer 25 to 30 cm. deep, rich in humus, a low moor, and a light sandy heath. These tracts were subdivided and given varying quantities of Thomas phosphate meal and kainit, with and without irrigation. The plats were irrigated by running and still water so as to compare the methods.

The average yield per acre without fertilizers on the first tract was increased 77 per cent by irrigating with running water, and 50 per cent by flooding in checks. With the application of a small amount of Thomas phosphate (150 kg. per hectare annually) there was a further increase of about 33 per cent, while additional quantities showed very small increases in the crop. Kainit alone showed no increase at all when applied at the rate of about 500 kg. per hectare annually, as the lands were not deficient in potassium salts. The other tracts show quite similar results.

In all cases the method of irrigating with moving water appears to give larger yields than the check-flooding method, averaging on the first tract 28 per cent greater, on the second 34 per cent, while on the third the advantage is even more marked. The running water is applied by ridging the land, and apparently not by furrows as in the United States. The author urges independent local experiments and cautions against accepting the data given as applicable under different conditions of soil and ground water.

Irrigated lands in Idaho (*The State of Idaho. Boise, 1905, pp. 59–62*).—A summary of irrigation statistics is presented, showing 3,600 miles of canals costing nearly $10,000,000 and covering over 2,000,000 acres, of which 840,000 are now under cultivation. The publication contains also articles on projects under the Carey Act and the Reclamation Act, and brief descriptions of irrigation systems by counties. The report is profusely illustrated.

[Irrigation in Wyoming] (*The State of Wyoming. 1905, pp. 54–79, pls. 6*).—Under the titles Public Lands and Irrigation Projects, State Lands, and How to Obtain a Right to Use Water in Wyoming, a review is given of Reclamation and Carey Act projects, ditches built and projected by private parties, and the laws relating to public lands and water rights.

Method and cost of constructing cement pipe in place, H. P. GILLETTE (*Engin. Rec., 53 (1906), No. 10, pp. 349, 350, figs. 2*).—The Ransome method of making continuous cement sewer pipe in place, which is described here, suggests the use of the same machine for drain pipes.

The device consists of a core 10 ft. long, with a sectional sheet-iron mold. The cement is rammed into place by hand, and the whole machine is moved gradually forward by winding up a cable by a lever and ratchet windlass. The actual cost of laying 8-in. pipe at Rochester, N. Y., was 6.6 cts. per foot, and for 12-in. pipe 10.25 cts. per foot, 300 to 400 ft. a day being laid with a crew of 7 or 8 men. While the pipes laid are said to be as tight as cement-jointed vitrified pipe, it would not be difficult to make them porous enough for drainage by using less cement or by providing openings.

An investigation of the ancient hydraulic works in Algeria, S. GSELL (*Paris: Govt., 1902, pp. 143, figs. 27*).—This report consists of descriptions of hydraulic works of Roman origin found in the various provinces of Algeria, written by local administrative officers, engineers, or army officers familiar with particular localities. There are described about 80 barrages, 30 reservoirs, 20 aqueducts, and a large number of smaller hydraulic works formerly used for irrigation or city water supplies.

Strainers for driven wells, D. H. MAURY (*Engin. News, 55 (1906), No. 10, pp. 260, 261, figs. 3*).—While fine strainers have been generally favored because they exclude fine sand, their capacity and durability are low.

The principle of the coarse strainer is that fine sand is freely admitted and may be pumped out, thus washing all the fine material from a zone surrounding the strainer and creating what is virtually a strainer of clean gravel having a large capacity, and since a certain initial velocity is required to start fine material toward the well, no silt will be drawn in when pumping any less water than the maximum capacity of the sand pump.

The author describes several well-strainers and the methods of perforating well casings after driving.

Mountain road construction in Idaho, E. B. DARLINGTON (*Engin. News, 55 (1906), No. 11, pp. 282, 283*).—The legislature of Idaho in 1905 authorized the expenditure of $50,000 for mountain roads, under the supervision of a State commission, the cost of new roads to be divided with the community benefited.

Over 100 miles of road have already been built or are nearing completion under this law. It is the policy of the commission to spend only $500 to $1,000 per mile, the roads being 8 to 12 feet wide, with a maximum grade of 12 per cent. Turnouts are built every half mile. All running streams are bridged, culverts are built in dry channels, and swampy places are corduroyed, all such structures to be 12 ft. wide. The roads are carefully located with a view to future improvements.

Road maintenance, R. A. MEEKER (*Engin. Rec., 53 (1906), No. 13, pp. 424, 425*).—An article written for the annual report of the New Jersey commissioner of public roads. The problem of maintenance is to reduce wear and replace worn material cheaply. Good drainage is essential; the wearing surface should be hard, and should be kept free from dust by sweeping or scraping, if the rains do not keep it washed away. General repairs should be made in fall and spring, and prompt minor repairs at all seasons. The use of the best stone only is recommended.

RURAL ECONOMICS.

Depreciation in agricultural values, P. CAZIOT (*Jour. Agr. Prat., n. ser., 11 (1906), No. 7, pp. 203-206*).—The value of agricultural land in France advanced during most of the nineteenth century, but since 1880 there has been a very great decrease, the decrease being as great as 70 or 80 per cent in some instances.

In general the land of the peasant proprietors has decreased to a greater extent than that of large estates. The causes given for this depreciation are that capital invested in land yields smaller returns than formerly, due to changes in agriculture which make the land a relatively less important agent in agricultural production. Intensive cultivation has given to operating capital a greater importance than it for-

merly had in agricultural operations. A second cause assigned is the decrease in rural population, which has resulted in a rise in wages.

Report on the operation of agricultural insurance societies, A. DE CÉRIS (*Jour. Agr. Prat., n. ser., 11 (1906), No. 14, pp. 421, 422*).—The official journal of April 1 contains a report on the operation of mutual agricultural insurance societies.

There has been in the last 9 years a very great increase in the number of these societies. There were 1,484 such societies in 1897, and 6,556 in 1906. They insure live stock against death, agricultural buildings against fire, crops against hail, and farmers against accident. The total amount of risks carried is 3,920,100 francs (about $785,000). The government supervises the organization of the new societies, paying special attention that the rates are high enough to insure payment of indemnities. It also supervises in a limited way the operation of societies and aids them in case of special need resulting from epidemics.

The government has encouraged so far as possible the federation of the smaller societies in order that they may have greater stability.

The loans of the Credit Foncier for agricultural enterprises, A. DE CÉRIS (*Jour. Agr. Prat., n. ser., 11 (1906), No. 14, p. 422*).—The commission appointed by the ministry of agriculture to make a study of the Credit Foncier and recommend modifications to make its loans more popular, has recommended that loans for drainage and other agricultural improvement shall be made easier, that loans should be extended to agricultural societies organized under the laws of 1865–1888, that interest should be lowered, and that the system of guaranteeing reimbursement be revised.

Meat in foreign markets, tariffs of fourteen importing nations, and countries of surplus (*U. S. Dept. Agr., Bur. Statis. Bul. 39, pp. 95*).—This bulletin contains a summary of information concerning the export trade in American meat, animal and packing-house products, the customs tariffs of 14 of the principal countries importing these animals and products, and the conditions of production of these commodities for export in 12 countries which are, or may become, competitors of the United States in this industry.

Meat animals and packing-house products imported into eleven principal countries, 1895–1904 (*U. S. Dept. Agr., Bur. Statis. Bul. 40, pp. 92*).—The value of the meat animals and packing-house products imported into 13 European countries and Cuba in 1904 was $506,715,512. Of the total amount sent to 11 of the countries included, the United States supplied 40.38 per cent.

Norway, Sweden, and Russia as markets for packing-house products (*U. S. Dept. Agr., Bur. Statis. Bul. 41, pp. 21*).—Information obtained from published official reports is summarized and classified.

The value of meat and other packing-house products imported into Norway in 1902–1904 had a value of $4,585,000, an increase of 29 per cent over 1895–1897. In Sweden the total value of these products imported was $4,227,000 in 1901-1903, and in Russia $4,337,000. In Sweden the increase since 1895–1897 was 62.3 per cent. "Russia being primarily an agricultural country with an enormous export of grain, and the Russian people consuming very small quantities of meats, the imports of meat animals and packing-house products are very small and do not show any strong tendency to increase."

Cotton production and statistics of cotton-seed products, 1905 (*Bur. of the Census [U. S.] Bul. 40, pp. 72, maps 2*).—This bulletin gives cotton statistics of the United States for the years 1902, 1903, 1904, and 1905; sketches the history of the production of cotton throughout the world; discusses the possible increase of cotton growing in the United States and other countries; and describes the products made from cotton seed, giving statistics.

The total production of cotton in the United States in 500-lb. bales was 10,827,168 in 1902, 10,045,615 in 1903, 13,679,954 in 1904, and 10,804,556 in 1905. The estimated value of the cotton crop was $501,897,134.65 in 1902, $660,549,230.82 in 1903,

$652,031,635.97 in 1904, and $632,298,322.57 in 1905. The conclusion reached regarding the production of cotton in foreign countries is that only in the remote future is there a prospect of any other country than the United States producing any large amount of cotton for export.

There has been a very large increase in the establishments making cotton-seed products since 1900, the number in that year being 369, and 715 in 1905. The value of the products increased from $19,335,947 in 1890 to $96,407,621 in 1905. These products include linters, hulls, and oil.

An introduction to the history of sugar as a commodity, ELLEN D. ELLIS (*Bryn Mawr Col. Monographs, 4 (1905), pp. 117*).—This monograph presents a study of the statics and dynamics of sugar and of the history of the substance as a commodity in various countries of the world. A list of over 100 references bearing on the subject from a practical, historical, geographical, and technical standpoint is given.

AGRICULTURAL EDUCATION.

Higher agricultural education, E. A. BRYAN (*Pullman, Wash.: Author, 1905, pp. 16*).—An address delivered before the Educational Congress of the Lewis and Clarke Exposition at Portland, Oreg., in which the aims of pure and applied science are set forth, and the development of agricultural education in the United States is outlined. Agricultural education is characterized as genuine, real education which can not do without the old instruments of education, but which "has added new and better instruments for the purpose of mind growth along certain directions, namely, that of the life which the student is to lead."

Educational agriculture, W. R. HART (*Peru, Nebr.: Author [1906], pp. 16*).—This is a discussion of the pedagogics of agriculture based on the premise that "before agriculture becomes entitled to a permanent place in the common school course it must withstand three tests: First, the test of usefulness; second, the test of mental discipline; third, the test of humanizing culture." The conclusion of the author is "that from whatever point of view the subject is approached, agriculture gives an affirmative answer to every test that can be applied to any subject, not excepting the richest, in any course of study."

How can a college of agriculture keep close to the ground? L. H. BAILEY (*Cornell Countryman, 3 (1906), No. 9, pp. 207, 208*).—The writer discusses means of bringing the people and the college closer together, and among other things suggests the sending of college students to approved farms to learn advanced farm practice, and the bringing of experienced farmers to the college to lecture and consult informally with students.

Proceedings of the nineteenth annual convention of the Association of American Agricultural Colleges and Experiment Stations held at Washington, D. C., November 14–16, 1905, edited by A. C. TRUE, W. H. BEAL, and H. C. WHITE (*U. S. Dept. Agr., Office Expt. Stas. Bul. 164, pp. 189, dgms. 2*).—An account of this convention has been given (E. S. R., 17, p. 321).

Proceedings of the tenth annual meeting of the American Association of Farmers' Institute Workers, edited by W. H. BEAL, J. HAMILTON, and G. C. CREELMAN (*U. S. Dept. Agr., Office Expt. Stas. Bul. 165, pp. 95*).—This is a detailed account of the proceedings of the meeting held at Washington, D. C., November 9–11, 1905.

Animal husbandry—four-year course, R. S. SHAW (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 142–144*).—This is a syllabus of a course in animal husbandry for graduates of a good high school, followed by a discussion of some features of the syllabus. Out of a total of 382 hours in the course 129½ hours are devoted to animal husbandry subjects, 30 hours to other agricultural subjects, and 25½ hours to hygiene, anatomy,

and veterinary science. The remainder of the time is taken up with English, mathematics, chemistry, botany, bacteriology, and drawing.

Course in cheese making for movable schools of agriculture, L. L. VAN SLYKE (*U. S. Dept. Agr., Office Expt. Stas. Bul. 166, pp. 63*).—This is the first of a series of courses designed to give more extended and specific instruction in agriculture outside of regularly organized schools than is now being given in the farmers' institutes. A brief statement concerning the plan for the movable schools is given in a prefatory note by the farmers' institute specialist of this Office. The course outlined in this bulletin consists of 14 lectures accompanied by 14 practicums. The bulletin also contains a list of apparatus needed in giving the course in cheese making and lists of references to the literature of the subject.

Syllabus for a four-year course in horticulture, U. P. HEDRICK (*Rpt. Mich. Acad. Sci., 7 (1905), p. 141*).—This is a syllabus of a course in horticulture suitable for graduates of a good high school. Required horticultural subjects occupy 65 out of a total of 420 hours, and this number may be increased to 110 hours by choosing senior electives in horticulture.

Teaching horticulture in high schools (*Agriculture* [*Nebr.*], *5 (1906), No. 2, pp. 2–6*).—Reasons for teaching horticulture and topics best suited for horticulture in high schools are given, also some items of necessary equipment, the most important of which is the school garden.

Topics in horticulture for common schools, U. P. HEDRICK (*Rpt. Mich. Acad. Sci., 7 (1905), p. 140*).—Horticultural topics suitable for common schools are arranged under the three heads propagation of plants, vegetable gardening, and pomology.

Outline for a brief course in agricultural economics, K. L. BUTTERFIELD (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 149, 150*).

Outline for a brief course in rural sociology, K. L. BUTTERFIELD (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 150, 151*).

Courses in some phases of rural economy. Outline for a course in farm management, F. W. CARD (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 148, 149*).

Teaching agricultural economics in the agricultural high schools, E. VLIEBERGH (*Rev. Gén. Agron., 14 (1905), Nos. 10–11, pp. 444–452*).—The author states that agricultural economics might be held to include studies of agricultural practice and also studies of economic, social, political, and legal conditions, but confines his discussion to the latter. A complete course of instruction is outlined. It includes property rights in land; rents; statistics; land taxes; tariff; public regulations; size of land holdings; succession; subdivision of holdings; credit; capital; labor; insurance; agricultural associations; teaching of agriculture; sanitary regulations, etc. It is recommended that class work be supplemented by the preparation of monographs, students studying conditions in their home communities and by seminar work.

How to determine what to teach in nature study, L. A. HATCH (*Nature-Study Rev., 2 (1906), No. 1, pp. 13–17*).—An argument in favor of teaching nature study with a clearly defined object in view. The writer holds that in planning a course in nature study "(1) A vital human relation should be found in all the work undertaken; (2) the course should contain within itself a rich content that is worth studying; (3) there should exist an intimate relation among the parts, holding the same together in such a manner that the work covered from year to year will be progressive and united."

Nature study in its practical bearings, J. P. STEWART (*Nature-Study Rev., 2 (1906), No. 2, pp. 55–66; reprinted from* [*Ill.*] *Normal School Quart.*).—A discussion of the reason for teaching nature study, its relation to agricultural teaching, what it should include, the principles that should guide in its organization and presentation, and the place where it should be taught. The writer's answer to the last question is "The all-important place for nature study is in the country school." The two prob-

lems for discussion in reaching the country school are (1) how to reach the teacher and (2) what to do in these schools, and how.

The relation of nature study to manual training, W. A. BALDWIN (*Nature-Study Rev., 2 (1906), No. 2, pp. 41-48, figs. 2*).—The writer discusses the relationships between these two subjects from 2 standpoints, that of the subject taught and that of the child. In the first case he shows that while nature study and manual training were once wide apart, they have been modified until they come very near together. Secondly, from the standpoint of the child, "the only true line of approach," he finds that it is difficult to distinguish between the two—that with the child at home on the farm most of nature study is also manual training, and vice versa.

Experiences in school gardening, J. B. DANDENO (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 156-160*).—An argument against the feasibility and desirability of conducting school gardens in rural schools based on the experience of the writer in growing plants and trees in a country school, and against teaching elementary agriculture in such schools based on the premise that "agriculture is purely and necessarily an art," and that in order to teach it the sciences botany, zoology, chemistry, physics, mineralogy, and geology would have to be taught.

The school garden at Bowesville, Canada, E. A. HOWES (*Nature-Study Rev., 2 (1906), No. 2, pp. 48-55, figs. 2, dgm. 1*).—An interesting account is given of a successful experiment "to determine what might be accomplished along the line of nature study by means of a school garden in a large ungraded rural school, under stable conditions, by a trained teacher supposed to be interested in the work." While the work in the lower grades did not differ materially from other school garden work, that in the upper grade consisted largely of cultural and spraying experiments with potatoes, this crop being one of the leading staples of the region.

The preparation of teachers for the rural common schools, E. BURNHAM (*Rpt. Mich. Acad. Sci., 7 (1905), pp. 152-155*).—After discussing some of the essentials of training for rural school teachers, the author considers the county normal training classes now in vogue in Michigan and the courses for rural teachers in the State normal schools.

The school garden and the country school, G. D. FULLER (*Ottawa Nat., 19 (1906), No. 12, p. 235-246, dgm. 1*).—An account of school garden work in connection with a Macdonald rural school at Brome, Quebec, giving particulars regarding the conduct of the garden work during the winter and spring terms, and in the summer vacation.

True nature study: Its fundamentals and its relation to some other subjects, J. V. CRONE (*Nature-Study Rev., 2 (1906), No. 5, pp. 177-184*).

Nature study and gardening, ESTELLE REEL (*Washington: Govt. Printing Office, 1905, pp. 27, figs. 4*).—A bulletin giving suggestions to teachers in Indian schools regarding nature study lessons, window boxes, and gardening.

Education in Indian rural schools. A plea for nature study, F. G. SLY (*Agr. Jour. India, 1 (1906), No. 2, pp. 115-122*).—An argument for rural school instruction dealing with concrete objects before abstract, proceeding from the known to the unknown, and basing instruction upon the familiar surroundings of the child.

"The familiar surroundings of the rural school boy are essentially agricultural, so that his education should very largely be based upon agriculture." A distinction is made between teaching agriculture, which is not recommended, and teaching nature study through the use of agricultural material, which is strongly urged. Suggestions are given for training teachers in cooperation between the education and agricultural departments of India.

Royal Hungarian Central Viticultural Institute (*L'Institut Central Ampelologique Royal Hongrois. Budapest, 1905, pp. 15, figs. 6, dgms. 2*).—This is a description of the organization, buildings, and other equipment of the Royal Hungarian Central Viticultural Institute opened at Budapest in 1904. The institute includes divisions of

biology, chemistry, zymology, and viticulture and enology, each under a chief subordinate to the director of the institute. The buildings include a main building containing offices, library, museum, auditorium, lecture rooms, and laboratories, and 4 separate laboratory buildings, one for each division. In the vicinity of the buildings are several vineyards containing American and European vines and hybrids.

Agricultural education in India, J. Harward (*Trop. Agr. and Mag. Ceylon Agr. Soc., 25 (1905), No. 5, pp. 717-722*).—An historical and general account of agricultural education in India, including the work done in agricultural colleges, secondary schools, and rural schools.

Schools for colonial agriculture, Reinecke (*Tropenpflanzer, 10 (1906), No. 4, pp. 238-243*).—An account is given of the schools for colonial agriculture existing in the different countries of Europe and European colonies.

MISCELLANEOUS.

Fourteenth Annual Report of Colorado Station, 1901 (*Colorado Sta. Rpt. 1901, pp. 53*).—This report, recently issued, contains a financial statement for the fiscal year ended June 30, 1901; and reports of the director, heads of departments, and field agents of the station, parts of which are abstracted elsewhere in this issue. The report of the Plains Substation includes notes on weather conditions, various horticultural and field crops grown during the year, stock raising, irrigation, and other topics.

Report of Florida Station, 1903 (*Florida Sta. Rpt. 1903, pp. 19*).—This contains a report of the director, a financial statement for the fiscal years ended June 30, 1902-3, a list of the bulletins issued by the station, and brief reports of the heads of departments.

Report of Florida Station, 1904 (*Florida Sta. Rpt. 1904, pp. 22*).—This contains a report of the director, a financial statement for the fiscal year ended June 30, 1904, departmental reports, and a list of the publications of the station available for distribution.

Seventeenth Annual Report of Illinois Station, 1904 (*Illinois Sta. Rpt. 1904, pp. 13*).—This contains a brief statement concerning the principal lines of station work during 1904, a list of the bulletins published by the station, and a financial statement for the fiscal year ended June 30, 1904.

Twentieth Annual Report of Maine Station, 1904 (*Maine Sta. Rpt. 1904, pp. 226*).—This is made up entirely of reprints of Bulletins 100-111 of the station which were issued during the year.

Twenty-first Annual Report of Maine Station, 1905 (*Maine Sta. Rpt. 1905. pp. 268*).—This is made up entirely of reprints of Bulletins 112-124 which were issued during the year.

Fourteenth Annual Report of New Mexico Station, 1903 (*New Mexico Sta. Rpt. 1903, pp. 30*).—This contains a report of the director on the work of the station during the year with a list of press bulletins issued, periodicals received by the station, and a list of the available bulletins and reports to date. Departmental reports containing in some instances experimental work are included and a financial statement is given for the fiscal year ended June 30, 1903.

Twenty-third Annual Report of the New York State Station, 1904 (*New York State Sta. Rpt. 1904, pp. 457*).—This contains a financial statement for the year ended September 30, 1904, a list of periodicals received by the station, meteorological observations noted elsewhere, and reprints of Bulletins 245-260 of the station.

Ohio Agricultural Experiment Station (*Ohio Sta. Circ. 48, pp. 3*).—This calls attention to the nature and results of the work of the station as a justification for asking for an increase in the State appropriation.

Fifteenth Annual Report of Wyoming Station, 1905 (*Wyoming Sta. Rpt. 1905, pp. 77*).—This includes the organization list, a report of the director on the work and publications of the station during the year, a financial statement for the fiscal year ended June 30, 1905, and reports of the heads of departments, parts of which are noted elsewhere. The director's report contains also statements concerning recent State legislation of interest to the station.

A report on lamb feeding experiments has been noted from another publication (E. S. R., 17, p. 688). Analyses of forage plants are reprinted from Bulletin 65 of the station (E. S. R., 17, p. 240).

Report of the Secretary of Agriculture, 1905, JAMES WILSON (*U. S. Dept. Agr., Rpt. 81, pp. 100*).—This is a separate of the Secretary's report previously noted (E. S. R., 17, p. 923).

Publications of the Office of Experiment Stations issued during 1905 and station publications received by the Office of Experiment Stations during 1905 (*U. S. Dept. Agr., Office Expt. Stas. Circ. 66, pp. 14*).—Previous lists of this kind have been published in the bulletins and annual reports of this Office, and recently reprinted and distributed in the form of separates, which with the present circular furnishes a complete list of all the publications of this Office and the experiment stations since their organization up to the end of 1905.

Accessions to the Department Library, 1906 (*U. S. Dept. Agr., Library Bul. 59, pp. 77*).

NOTES.

Alabama College and Station.—W. T. Clarke, assistant superintendent of university extension and assistant in entomology of the California University and Station, has been appointed entomologist of the station. W. Gilder, a graduate of the veterinary college of Cornell University, has been appointed assistant in veterinary science, vice I. S. McAdory, resigned. D. T. Gray has been promoted to assistant professor of animal industry. E. R. Miller, formerly in charge of the department of pharmacy and recently connected with the Cuban experiment station, has been elected professor of pharmaceutical chemistry, vice W. H. Blome, resigned to engage in commercial pursuits.

Connecticut State Station.—The station entomologist is devoting his attention to the gypsy moth, which has made its appearance in the State. One square mile of territory near Stonington is said to have been invaded.

Georgia College.—The State legislature has appropriated $100,000 for the purpose of erecting and equipping buildings for the agricultural college. Through the efforts of the alumni of the institution, the university has recently acquired 500 acres of land adjoining the campus.

Illinois University and Station.—W. C. Coffey has been appointed instructor in sheep husbandry and D. O. Barto instructor in agriculture. Mr. Barto will make a study of those phases of agriculture suitable for use in secondary schools. The following additions have been made to the station staff: L. Hagenaur and A. F. Kidder, department of agronomy; H. O. Allison, department of animal husbandry; and J. M. Barnhart, department of dairy husbandry.

Kentucky Station.—George Roberts has been appointed assistant chemist.

Maryland Station.—C. W. Melick, assistant in dairy husbandry at the Kansas Agricultural College, has been appointed dairyman of the station to take effect September 1. H. Jennings, a graduate of Cornell University, in the class of 1906, has been appointed poultryman to take effect September 1. E. H. Brinkley, formerly of the station, has been appointed assistant in demonstration work to take effect October 1. The last two positions have been provided for by station appropriations.

Massachusetts Station.—L. S. Walker was appointed assistant chemist in the division of foods and feeding July 1, vice A. C. Whittier, resigned.

New Hampshire College.—Dr. T. J. Headlee has been appointed entomologist and F. W. Putnam assistant professor of drawing.

Cornell University.—Dr. T. L. Lyon, recently appointed professor of experimental agronomy in the college of agriculture, will devote his time to research, taking up his work about September 1. Dr. G. F. Warren, horticulturist of the New Jersey Station, has been appointed assistant professor of agronomy. E. O. Fippin, heretofore detailed by the Bureau of Soils of this Department, will remain with the university as assistant professor of agronomy with reference to soils. J. W. Gilmore, instructor in agronomy, has been made assistant professor of agronomy. The college of agriculture now has six professors in agronomy. C. F. Clark has been appointed assistant agronomist.

New York State Station.—Director W. H. Jordan has been granted a four months' leave of absence, the first half of which he will spend in the West. E. B. Hart, associate chemist, has resigned to accept the position of professor of agricultural chemistry in the University of Wisconsin, and chemist of the experiment station. Increased appropriations for the next fiscal year have permitted the following promotions and additions to the station staff: W. J. Schoene, assistant entomologist; James Wilson, of the Oklahoma Agricultural College, assistant bacteriologist; Richard Wellington, of the Massachusetts Agricultural College, assistant horticulturist; and G. T. French, of the Massachusetts Agricultural College, assistant botanist.

Ohio Station.—Edmund Secrest, a graduate of the Kansas Agricultural College and recently connected with the Forest Service of this Department, has been appointed assistant in forestry at the station.

Oklahoma Station.—W. L. English, a graduate of the Oklahoma Agricultural and Mechanical College, for some time assistant in animal husbandry in the college and station, and at present engaged in farming in Pottawatomie County, Okla., has been appointed director of the Oklahoma Agricultural Experiment Station, and will assume the duties of the position September 1, 1906.

Rhode Island College and Station.—Dr. Cooper Curtice has resigned to take up work in the Bureau of Animal Industry of this Department in connection with the eradication of the Texas fever tick. J. G. Halpin, instructor in poultry husbandry in the college, has resigned to accept a similar position in the Michigan Agricultural College. J. W. Bolte, a graduate of the Michigan Agricultural College and poultryman of the Utah College and Station, has been appointed assistant professor of animal industry and will have charge of poultry instruction. He will also be connected with the experiment station. Prof. F. C. Black, of the Indiana Normal University and College of Applied Science, has been appointed to the chair of highway engineering and will begin his new duties in September.

Tennessee Station.—S. E. Barnes, dairyman of the station, has been engaged by the dairy division of the Bureau of Animal Industry to do field work in Tennessee in the interests of dairying, in which work he will cooperate with the station. The vacancy has been filled by the appointment of J. N. Price. L. R. Neel has been appointed assistant in plat work, vice J. E. Converse, resigned to become manager of a farm in the vicinity of Knoxville.

Utah Station.—James Dryden, formerly connected with the station and more recently poultryman of the Montana Station and at present with the Cyphers Incubator Company, of Buffalo, N. Y., has been appointed poultryman, vice J. W. Bolte, resigned. C. Larsen, assistant in dairying at the Iowa College and Station, has been appointed dairyman to fill the vacancy caused by the resignation of J. A. Crockett, who will engage in private business.

Virginia College and Station.—Prof. R. J. Davidson, dean of the scientific department and chemist of the station, has severed his relations with the station in order to devote his entire time to the scientific department. The vacancy on the station staff has been filled by the appointment of Dr. W. B. Ellett, assistant chemist of the station. It is planned to reorganize the department with a first assistant and one or two laboratory assistants and to undertake new lines of investigation made possible by the Adams Act. W. L. Owen, recently appointed to take charge of the cooperative investigations in light tobacco at Chatham, Va., has resigned to accept a position in bacteriology in the Georgia Station. The vacancy has been filled by the appointment of R. P. Cocke. The State farmer's institute recently held at Roanoke was attended by 1,200 farmers, of whom 1,050 visited the college and station on a special train provided for their accommodation.

Bequest to the University of California.—The estate of the late M. Theodore Kearney, near Fresno, comprising about 5,000 acres of land, valued at nearly $1,000,000 and yielding an annual income of about $50,000, has been bequeathed to the University

of California, preferably for endowment of agricultural education and research. President Wheeler has expressed his belief that the trustees of the university will assume the responsibilities involved in accepting this trust.

International Congress of Agriculture.—The Eighth International Congress of Agriculture will be held at Vienna, Austria, May 21–25, 1907. The previous Congresses were held at Paris, 1889; The Hague, 1891; Brussels, 1895; Budapest, 1896; Lausanne, 1898; Paris, 1900, and Rome, 1903. A pamphlet has been issued giving the organization, regulations, and programme of the forthcoming congress. This contains the subjects for discussion of each of the eleven sections in which the congress is to be divided. All reports intended for the congress should be sent to the executive committee before December 1, 1906. Persons desirous of becoming members should notify the executive committee and pay the membership fee of 20 kronen ($4) before March 31, 1907. The secretary of the executive committee is Prof. Josef Häusler, Vienna, Austria, I. Schauflergasse 6.

Indian forestry college.—In order to make better provisions for research work in forestry, and to secure a permanent staff of forest experts for scientific research, as well as for training candidates for the government and state forestry service, the Imperial Forestry School at Dehra Dun, India, has been enlarged and hereafter will be known as the Imperial Forestry Research Institute and College. The college staff will include officers of the imperial service, holding the following positions: (1) Sylviculturist, who will make sylviculture his special study. (2) Superintendent of Forest Working Plans, who will collect and collate statistics of the results of forestry management throughout India. (3) Forest Zoologist, who will investigate the damages caused by insects and other pests. (4) Forest Botanist, who will study the botany of forest plants, distribution of species, diseases of forest trees, etc. (5) Forest Chemist, who will investigate the chemical properties of soils and forest produce. (6) Forest Economist, who will study economic methods of commercial timber production and marketing.

These officers, while engaged primarily in research work, will each deliver a course of lectures on his special subject in the college, and take part in the training of the students. The work of instruction, however, will for the most part be carried on by four assistant instructors.

Miscellaneous.—*Science Progress*, published in London from 1894 to 1898, has been revived under the name *Science Progress in the Twentieth Century*. The journal is to be issued quarterly. The first number contains, among others, articles on The Solvent Action of Roots upon the Soil Particles, by A. D. Hall; On the Occurrence of Prussic Acid and its Derivatives in Plants, by T. A. Henry; Some Notable Instances of the Distribution of Injurious Insects by Artificial Means, by F. V. Theobald; The Corn Smuts and their Propagation, by T. Johnson; and the Utilization of Proteids in the Animal, by F. G. Hopkins.

J. B. Mowry has been appointed commissioner of forestry in Rhode Island.

William Farrer, wheat specialist to the department of agriculture of New South Wales, died April 17, 1906. Mr. Farrer was noted especially for his work in the improvement of wheat by cross-breeding and selection, particularly in the direction of producing types resistant to rust and drought.

Prof. Gustav W. Lehman, prominent as a food chemist, died in Baltimore, August 5, 1906.

Dr. George W. Atherton, president of The Pennsylvania State College, died at that place July 24, 1906.

Last autumn, in the hope that a milder climate might be helpful, he went to southern California, where he spent the winter. Although the change for a time seemed beneficial, yet the relief proved to be but temporary. Upon his return home he gradually grew weaker until his disease culminated in death. At the last commencement, although extremely weak, he expressed a desire to meet the graduating

class and confer the degrees. This was his last public service to the institution over which he had presided for 24 years.

During his presidency the college developed from an institution with a small number of students, few buildings, and an inadequate teaching force to its present large attendance, ample equipment, and high position as an educational institution. Much of this progress was due to Doctor Atherton's indefatigable energy and intelligent interest in the development of technical education.

Doctor Atherton was born in Boxford, Mass., June 20, 1837. At the age of 12 his father died, leaving him with his mother and sister only partially provided for. His first employment was in a cotton mill, and later upon a farm. He worked his way through Philips Exeter Academy and Yale College, being graduated from the latter institution in 1863. He served in the civil war from 1861-63 as lieutenant and captain in the Tenth Connecticut Volunteers; was a teacher in the Albany Boys' Academy, 1863-67; professor in St. John's College, Annapolis, Md., 1867-68, and in the University of Illinois, 1868-69; was professor of political economy in Rutgers College, New Jersey, 1869-82; and president of The Pennsylvania State College, 1882-1906. The degree of LL.D. was conferred upon him by Franklin and Marshall College in 1883. He was one of the original organizers of the Association of American Agricultural Colleges and Experiment Stations, and was the first president of the organization.

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NOTE.—The abbreviations "Ala. College," "Conn. State," "Mass ," etc., after entries refer to the publications of the respective experiment stations; "Alaska," "Hawaii," and "P. R." to those of the experiment stations in Alaska Hawaii. and Porto Rico; "Can." to those of the experiment stations in Canada, and "U. S. D. A." to those of this Department.

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